#24 1/2

U.S. Patent 6,292,547

Document 1 - Page 1 of 1

Downloaded from publicsource.org

6,292,547

U.S. Patent Number 6,292,547
Inventor: Ronald A. Katz
Issue Date: September 18, 2001

All claims of U.S. Patent No. 6,292,547 are invalid in light of the following prior art:

- Moosemiller, John. P. "AT&T's CONVERSANT Voice System." *Speech Technology* – Mar./Apr. 1986 pp. 88-93;
- U.S. Patent No. 4,755,872 ("Bestler *et al.*");
- Perdue, Robert J. and Eugene L. Rissanen. "CONVERSANT 1 Voice System: Architecture and Applications." Sept./Oct. 1986;
- Canadian Patent No. 1,162,336 ("DeBruyn");
- Emerson, "Voice Response Systems – Technology to the Rescue for Business Users." *Speech Technology* – Jan./Feb. 1983 pp. 99-103; and
- U.S. Patent No. 4,438,824 ("Mueller-Schloer").

Accompanying this submission, please find one or more claim charts applying one or more of the above cited prior art references being applied to one or more claims from U.S. Patent No. 6,292,547.

Accompanying this submission, please find a copy of *Ronald A. Katz v. AT&T Corp.*, 63 F.Supp.2d 583 (E.D. Pa. 1999), in which that court construed some elements of patent claims issued to Ronald A. Katz and a copy of *Marlow Indus., Inc. v. Igloo Prod. Corp.*, No. 02-1386, 2003 WL 21212626, (Fed. Cir. May 23, 2003)(unpublished).

Received - USPTO

Pursuant to 37 U.S.C. §1.555, "each individual associated with the patent owner in a **reexamination** proceeding has a duty of candor and good faith in dealing with the [Patent] Office, which includes a duty to disclose to the Office all information known to that individual to be material to patentability in a reexamination proceeding" (*See* 37 U.S.C. §1.555 and MPEP 2280)(emphasis added). "Informing the examiner of the pending infringement action is not commensurate with bringing to the examiner's attention the districts court's prior claim construction of the patent or disclosing the court orders embodying this construction. *See Rohm & Haas Co. v. Crystal Chem. Co.*, 722 F.2d 1556, 1572-73, 220 USPQ 289, 302 (Fed. Cir. 1983) (concluding that a presumption that an examiner was able to find, with his expertise and adequate time, the critical data when he was presented with a **"mountain of largely irrelevant data"** ignores the real world conditions under which examiners work)." *Marlow Indus., Inc. v. Igloo Prod. Corp.*, No. 02-1386, 2003 WL 21212626, at *2-3 (Fed. Cir. May 23, 2003)(unpublished)(*See Fed. Cir. Rule 47.6*)(emphasis added).

Pursuant to 37 U.S.C. §1.555, we believe that the prior art, decisions, opinions, orders, and arguments associated with the following proceedings may be pertinent:

- *West Interactive Corp. v. First Data Resources Inc.*, 1991 WL 355059 (D. Neb. July 22, 1991);
- *First Data Resources Inc. v. West Interactive Corp.*, No. 91-CV-4471 (C.D. Cal. August 20, 1991);
- *West Interactive Corp. v. First Data Resources Inc.*, 972 F.2d 1295 (Fed. Cir. 1992);
- *Ronald A. Katz Tech. Licensing, LP v. AT&T, Corp.*, No. 97-CV-539 (D. Neb. Oct. 27, 1997);
- *Ronald A. Katz Tech. Licensing, LP v. AT&T, Corp.*, No. 98-CV-88 (D. Neb. Mar. 2, 1998);
- *Ronald A. Katz Tech. Licensing, LP v. AT&T Corp.*, 63 F.Supp.2d 583 (E.D. Pa. 1999);
- *Ronald A. Katz Tech. Licensing, LP v. Micro Voice Applications Inc.*, No. 99-CV-592 (N.D. Cal. Feb. 8, 1999);
- *Enhanced Global Convergence Serv., Inc. v. Ronald A. Katz Tech. Licensing, LP*, No. 01-CV-375 (D. N.H. Oct. 5, 2001);
- *Verizon Cal., Inc. v. Ronald A. Katz Tech. Licensing, LP*, No. 01-CV-9871 (C.D. Cal. Nov. 16, 2001);
- *Enhanced Global Convergence Serv., Inc. v. Ronald A. Katz Tech. Licensing, LP*, No. 02-CV-66 (D. N.H. Feb. 2, 2002);
- *Ronald A. Katz Tech. Licensing, LP v. Verizon Communications Inc.*, 2002 WL 1565483 (E.D. Pa. July 16, 2002);
- *Ronald A. Katz Tech. Licensing, LP v. Verizon Communications Inc.*, 2002 WL 31834833 (E.D. Pa. Dec. 18, 2002); and
- *Ronald A. Katz Tech. Licensing, LP v. Verizon Cal., Inc.*, No. 03-CV-1918 (C.D. Cal. Mar. 18, 2003).

Document is available in the public domain

6651E0 Th2C260

Claims 1, 2, 9, 10: U.S. Pat. No. 6,292,547

Claim Elements	**The Prior Art – Moosemiller, John. P. "AT&T's CONVERSANT Voice System." *Speech Technology* – Mar./Apr. 1986 pp. 88-93**
A **control system** for use with a **communication facility** including **remote terminals** for individual callers, wherein each of said remote terminals comprises a telephonic instrument including a voice communication device, and a digital input device in the form of an array of alphabetic numeric buttons for providing caller data signals, said control system comprising:	"In September 1985, AT&T Conversant Systems introduced the CONVERSANT I Voice System, a voice response and speech recognition product for the growing market of automated information services." (p. 88). "This system accesses data bases via the public telephone network." (p. 88). Moosemiller describes the versatility of the Conversant with respect to its telephone network interface: "Most voice response systems only provide line interfaces to the telephone network, whereas the CONVERSANT I system adds many common trunk interfaces." (p. 88). "Telephones, rotary or touch-tone, can become instant terminals." (p. 88). The system uses voice and digital communication with the user: "The trunk interface answers an incoming call and communicates this to the system controller via the GPIB. Transaction software determines what greeting phrase to play. This is followed by a prompt to dial '1' for tone input, the voice response unit is attached, if not already dedicated, and commanded to play the phrases and collect touch-tone signals." (p. 88).
a **processor unit** for processing said caller data signals supplied by individual callers via said remote terminals;	The system has the capability to process both voice and digital data: "Transaction software determines what greeting phrase to play. This is followed by a prompt to dial '1' for tone input, the voice response unit is attached, if not already dedicated, and commanded to play the phrases and collect touch-tone signals. If no tones are heard, the unit signals the controller over to the GPIB and it dictates the switch to bridge on a speech recognizer." (p. 88 through p. 89). As can be seen on the table in pg. 9 the getdig() command in Transaction Script Language has the ability to receive data from the remote callers. These digits can then be "processed" by the CONVERSANT system. For example, in

Material claim element terms are in **bold**. Corresponding prior art disclosure is underlined.

Claims 1, 2, 9, 10: U.S. Pat. No. 6,292,547

	the table, the user response is verified by means of a database. The code is as follows: "getdig(DIG9,ch.LOGID.9) /* collect 9-digit response */ "dbase(0, VERIF, ch.RESP, RESPLEN, ch.LOGID, LOGLEN) /* verify host 0 data base */" (p. 91).
interface structure for interfacing said communication facility to said processor unit wherein said interface structure **receives data signals** prior to the close of communication with the caller, including **called number data signals (DNIS)** and **calling number identification data** signals automatically provided by said communication facility	The CONVERSANT system contains trunk interfaces to receive incoming 2-wire trunks or lines from the communication facility (See Fig. 1 on p. 89). By means of a General Purpose Interface Bus (GPIB), the trunk interfaces are able to interface the incoming 2-wire trunks or lines from the communication facility with the processor unit contained in the System Controller. The CONVERSANT system has the ability to receive DNIS signals from the communication facility. DNIS can then be used by the processor to classify the incoming call for different applications: "The Dialed Number Identification Service (DNIS) has been used with a Direct Inward Dialing (DID) trunk interface to receive dialed digits as part of the call setup protocol. This allows advance classification of incoming calls for different applications which are greeted by appropriate transaction prompts. The DNIS feature is useful for service bureaus or for multiple-user applications." (p. 88). Receiving ANI from a communication facility was well known in the art before Katz introduced the feature to his portfolio in February of 1987. For example, consider a report from the Yankee Group published in June of 1983 and entitled "Cable and the Telcos: From confrontation to détente." The Yankee Group Report discloses the use of calling number identification data for identification, qualification, and billing purposes:

Claims 1, 2, 9, 10: U.S. Pat. No. 6,292,547

and said **caller data signals supplied by the individual callers** via said remote terminals;	The central exchange office at the telephone company utilizes Automatic Number Identification (ANI) systems. The central exchange office forwards ANI data, specifically, the caller's telephone number, to the cable office. "When coupled with their Automatic Number Identification (ANI) systems – now used for long-distance call billing purposes – telcos are already well-equipped to automatically process PPV orders for cable operators." (Yankee Group Report, p. 163). Moosemiller discloses a system that allows for the Transaction State Machine to receive touch-tones from the interface: "Other instructions collect the user's speech or touch-tone signals." (p. 91).
voice generator for providing prompts to said individual callers in response to which said individual callers provide said caller data signals, said caller data signals including **caller qualification data** for qualifying said individual callers;	The system can qualify a user based on provided data. "Additionally, the system controller and the voice switch can allocate speech processing units as needed, thus time-sharing them." (p. 88). "For example, a catalog service user may log in with tone or speech recognition..." (p. 88).
testing caller customer number data as part of said caller qualification data supplied by the individual callers as at least certain of said caller data signals	Qualification can be completed using touch-tones, spoken words, spoken digits etc. Speech recognition can be used to determine digital data based on the caller's speech. "The following example illustrates logging into a service by voice entry or numeric ID." (p. 91).

Claims 1, 2, 9, 10: U.S. Pat. No. 6,292,547

against a file of stored customer number data;	Moosemiller describes how the speech recognition technology can be used to qualify callers: Described is "an automatic means of confirming the identity of a claimant based on historical speech patterns." (p. 90).
means for controlling said processor unit in accordance with said called number identification data signals **(DNIS)** to process at least certain of said caller data signals in accordance **with a select format** from a plurality of formats identified by said called number identification data signals (DNIS); and	The CONVERSANT system is capable of providing different applications, greetings, processing, etc. to different callers based on the dialed number. "The Dialed Number Identification Service (DNIS) has been used with a Direct Inward Dialing (DID) trunk interface to receive dialed digits as part of the call setup protocol. This allows advance classification of incoming calls for different applications which are greeted by appropriate transaction prompts. The DNIS feature is useful for service bureaus or for multiple-user applications." (p. 88).
a **switch that transfers the individual callers to a manual operation** in the event the individual callers do not qualify during the testing step.	Moosemiller discloses System Controller on pg. 89 that is capable of bridging a call to a system terminal and a system printer where an operator may sit. As seen in Fig. 1, "The system is capable of outdialing, bridging to an attendant for help or completing a partially automated transaction." (p. 89).

Claims 1, 2, 9, 10: U.S. Pat. No. 6,292,547

Dependent Claims	
Claim 2	**Bestler et al. U.S. Pat. No. 4,755,872 filed Jul. 29, 1985, issued Jul. 5, 1988**
A control system according to claim 1, wherein at least certain of said individual callers at certain of said remote terminals are also subject to **qualification based on said calling number identification data signals.**	As described above, claim 1 is invalid in light of the prior art. Bestler uses ANI for identification and qualification of a caller. Specifically, in order to be qualified, the caller must: 1) Have a telephone number that can be mapped to a particular cable converter (in other words, the caller must own a cable box). 2) Be qualified to receive pay-per-view-events. Qualification is determined by the cable company, and as disclosed by Bestler could include ensuring prompt bill payments by the caller, good credit etc. Bestler discloses a data base and a billing structure used to complete this qualification: The following elements are disclosed by Bestler to complete qualification via ANI data: Billing Computer 50 System Controller 46 Identify Converter Code 154 Error 158 "In the event that system control 46 cannot map the telephone number into a converter code (because, for example, of a wrongfully dialed telephone number), an error is generated at 158. That error can also be generated if the data base reflects the unavailability of the event for purchase by that particular subscriber, because of bad credit, tardy bill payments, or whatever reasons are considered to be adequate by the cable company." (Col. 15, Lines 9-17).

Claims 1, 2, 9, 10: U.S. Pat. No. 6,292,547

Claim 9	**The Prior Art - Bestler et al. U.S. Pat. No. 4,755,872 filed Jul. 29, 1985, issued Jul. 5, 1988**
A control system according to claim 1, wherein the caller data signals **include a second form of identification.**	As discussed above, claim 1 is invalid in light of the prior art Bestler discloses using two forms of identification. The first is the caller's telephone number as received by the ANI computer. The second is a pass-code entered as part of the dialed telephone number. Telephone number: "At 154, system controller 46 finishes mapping the telephone number too the unique address code of the converter of the cable subscriber." (Col. 15, Lines 2-4). Password: "Word 3 is used to make sure that the password is valid." (Col. 15, Lines 4-5).

Claim 10	**The Prior Art - Bestler et al. U.S. Pat. No. 4,755,872 filed Jul. 29, 1985, issued Jul. 5, 1988**
A control system according to claim 1, wherein said **file of stored customer number data includes negative file data.**	As discussed above, claim 1 is invalid in light of the prior art. Billing computer 50 had editing capabilities via a line 172 with data base 156. Thus, if desired by the cable company, the billing computer can edit the data base so that no cable subscriber can exceed some limitation per month on cable pay per view events. Also, the system can provide in this manner for preventing any pay per view events from being purchased by a cable subscriber while permitting normal cable operation." (Col. 15, Lines 40-48). "That error can also be generated if the data base reflects the unavailability of the event for purchase by that particular subscriber, because of bad credit, tardy bill payments, or whatever reasons are considered to be adequate by the cable company." (Col. 15, Lines 13-17).

Claim 21, 23, 25, 26, 43, 45: U.S. Patent No. 6,292,547

Claim Elements	**The Prior Art – Moosemiller, John. P. "AT&T's CONVERSANT I Voice System." *Speech Technology* – Mar./Apr. 1986 pp. 88-93.**	**The Prior Art – Perdue, Robert J. and Eugene L. Rissanen. "CONVERSANT 1 Voice System: Architecture and Applications." Sept./Oct. 1986**
A method for **implementing a service for controlling an order of an item or items**	"The applications AT&T CONVERSANT Systems has prototyped include: stock quotations, catalog ordering, airline reservations, dial-it information menus, caller destination control and telephone banking." (p. 92).	One example application disclosed by Perdue is the use of the CONVERSANT system for placing airline reservations over the telephone. (p. 40). Another example application is the ordering of stock quote information. "In its trial application, the system was installed on the premises of Fidelity Brokerage Service, Inc., in Boston. It provided callers with various stock market information, such as the Dow Jones industrial stock market average and prices and volumes of requested stocks and stock options." (p. 12).
for use with a **communication facility**	"This system accesses data bases via the public telephone network." (p. 88).	The figure on p. 35 shows incoming 2-wire trunks, and telephone lines which necessarily originate from a communication facility.
including **remote terminals** for individual callers, wherein each of said remote terminals comprises a telephonic instrument including a voice communication device and a digital input devices in the form of an array of alphabetic numeric buttons for providing data,	"Telephones, rotary or touch-tone can become instant terminals eliminating the need for costly computer peripherals and providing easy availability." (p. 88). The figure on p. 89 shows two trunk interfaces capable of receiving calls from remote telephones.	"The system answers telephone calls from lines and trunks… The caller can request information and direct the transaction by using either touch-tone or voice input." (p. 34).

Material claim element terms are in **bold**. Corresponding prior art disclosure is underlined.

Claim 21, 23, 25, 26, 43, 45: U.S. Patent No. 6,292,547

said method comprising the steps of:		
interfacing said remote terminals for **voice and digital communication** and **receiving data signals prior to the close of communication** from callers at said remote terminals including said caller data signals developed by said remote terminals;	"Callers access the system through touch-tone signals, speaking isolated words and connected digit strings ..." (p. 88) Fig. 1 on p. 89 shows the Trunk Interface connected to the Voice Response Unit (voice communication). Further, the Trunk Interface receives digital communication from the incoming 2-wire trunks or lines. "Instructions in the TSM script language were designed specifically for voice transactions. They include voice response instructions that speak phrases, numbers, and characters- in sensible ways with flexible intonation. Other instructions collect the user's speech or touch-tone signals..." (p. 91) As can be seen in Fig. 1 on p. 89 the trunk interfaces are connected to the System controller and Disks. On p. 91, within the table, is disclosed a code to receive digits from the caller: "getdig (DIG9, ch.LOGID.9) /* collect 9-digit response */ (p. 91).	"The system answers telephone calls from lines and trunks and provides verbal prompts and information to the caller." (p. 34). "The caller can request specific information and direct the transaction by using either touch-tone or voice input." (p. 34). "The caller can request specific information and direct the transaction by using either touch-tone or voice input." (p. 34).
providing **prompts to said individual callers in response to which said individual callers** can provide said caller data signals	The Transaction Script Language is used for voice instruction: "Other instructions collect the user's speech or touch-tone signals..." (p. 91).	Perdue discloses a system used by Fidelity that allows customers to access stock quotes. Each caller is given a 9-digit user identification number. The callers provide the number when prompted. "The 500 or so Fidelity customers who participated in the trial were each given a 9-digit user identification

Claim 21, 23, 25, 26, 43, 45: U.S. Patent No. 6,292,547

including caller qualification data for qualifying callers;	The example on p. 91, shows how a user logs-in based on a user ID. "The following example illustrates logging into a service by voice entry of a numeric ID." (p. 91).	number." (p. 45). "Answer call. 'Hello, Fidelity Automated Quotation Service, please enter the nine-digit ID code.'" As can be seen in Table I. Financial Information Transaction Dialog, a prompt is given for the caller to enter the code. The user is then qualified: Caller: "494327365" System: "Initials are JQP, correct?"(p. 43).
receiving from said callers **customer number data in addition to one other form of identification data** as a part of the caller qualification data;	Moosemiller discloses a speaker verification used in "confirming the identity of claimant based on historical speech patterns." (p. 90). Customer number is disclosed in the stock quotation application. One instruction disclosed is as follows: "LOG – validates user ID number, returns stock watch list." (p. 93).	"With speaker verification, the system will be able to ask a caller to enter an identification number and speak a special password or phrase." (p. 46).
verifying said customer number data and said one other form of identification data entered by said callers;	Customer number is disclosed in the stock quotation application. One instruction disclosed is as follows: "LOG – validates user ID number, returns stock watch list." (p. 93). Moosemiller discloses speaker verification "as a means of confirming the identity of a claimant based on historical speech patterns." (p. 90).	Perdue discloses "Speaker Verification," to verify the customer data. "The entered identification will be used to access a file containing the same password or phrase spoken earlier by the caller. A comparison, similar to a template match in speech recognition, is then made between the spoken password and the one on file. If the match is close enough, the caller is assumed to indeed be the owner of the entered identification and the transaction proceeds." (p. 46).

Claim 21, 23, 25, 26, 43, 45: U.S. Patent No. 6,292,547

receiving from said callers order data including **item data** entered by said callers via said digital input device;	"The applications AT&T CONVERSANT Systems has prototyped include: stock quotations, catalog ordering..." (p. 92).	Disclosed is the Fidelity Automated Quote Service, in which callers can get information about stocks. As seen, the caller is able to speak a number relating to a stock. Figure on p. 43 Perdue, on p. 40 illustrates a sample script for an airline reservation application.
receiving from said callers **additional data** relating to said item data	In the stock quotation application, the system is able to receive and transmit a variety of information concerning one stock. Including: "STK – accepts stock number, then outputs ticker symbol, and quote OPQ – accepts option number with its month and strike price, outputs option quote." (p. 93).	The caller is also able to request more information about the item by speaking codes relating to that item. As can be seen in Table 1, the user is able to access the price, volume, and options all for one stock. The caller gives a code relating to additional data for the stock.
processing said caller entered data to implement said order; and	Upon receiving the stock number, the System processes that number so as to receive the stock price from the FAQS Stock Quote Data Base. (See p. 92, Fig. 3, which shows the interface of the data base with the CONVERSANT system). The interface is over a 9600 Baud Link using 3270 BSC Protocol.	As seen in Table I, the system is able to process a received quote number. The caller speaks a number, and the CONVERSANT system retrieves a stock price based on that number: Caller: "541364672" System: "XON is at 60 ¼, down ¼, volume 29,200. Next stock ID?" (p. 43).
providing individual callers with **computer generated data to identify said order** for individual	The computer replies with a computer generated message concerning the information ordered for each stock quote.	The computer replies with a computer generated voice message representing the information requested by the user.

Claim 21, 23, 25, 26, 43, 45: U.S. Patent No. 6,292,547

callers.	For example, the STK command "outputs ticker symbol, and quote." (p. 93). As another example, the OPQ command "accepts option number with its month and strike price codes, outputs option quote" (p. 93).	For example, on p. 43 in Table I, the caller speaks: "697753147." The system processes this order for a price and responds with computer generated data to identify this order: "NSM last sale was at 11 7/8. First month code?"

Claim 21, 23, 25, 26, 43, 45: U.S. Patent No. 6,292,547

Dependent Claims	
Claim 23	**The Prior Art – DeBruyn, Canadian Patent No. 1,162,336 filed Jan. 8, 1981, issued Feb. 14, 1984**
A method according to claim 21, **wherein the computer generated number data is provided to the individual callers in chronological sequence.**	As described above, claim 21 is invalid in light of the prior art. DeBruyn discloses conversion and reply apparatus 11, "which converts the information to spoken language and informs the telephone subscriber thereof, so that the latter can check whether the correct Lotto numbers have been recorded." (p. 5, lines 24-26). These numbers are read back in the sequence that they were entered by the caller.

Claim 25	**The Prior Art – Emerson. "Voice Response Systems – Technology to the Rescue for Business Users."** ***Speech Technology*** **– Jan./Feb. 1983 pp. 99-103**
A method according to claim 21, wherein data identifying the order **facilitates tracing**.	The method according to claim 21 is invalid as described above. Emerson discloses using voice response technology for order taking. (p. 103). One ability of such a system is to report orders. "Using different access codes for customers, sales people, and managers, voice response systems automatically accept, confirm, change, delete, and report on orders." (p. 103).

Claim 21, 23, 25, 26, 43, 45: U.S. Patent No. 6,292,547

Claim 26	**The Prior Art – Moosemiller, John. P. "AT&T's CONVERSANT I Voice System."** ***Speech Technology*** **– Mar./Apr. 1986 pp. 88-93.**
A method according to claim 21, further comprising the step of receiving called number identification signals (**DNIS**) automatically provided by said communication facility as a part of said data signals.	As described above, claim 21 is invalid in light of the prior art. Moosemiller further discloses the use of DNIS. "The Dialed Number Identification Service (DNIS) has been used with a Direct Inward Dialing (DID) trunk interface to receive dialed digits as part of the call setup protocol." (p. 88).

Claim 43	**The Prior Art – Mueller-Schloer United States Patent No. 4,438,824 filed April 22, 1981, issued March 27, 1984**
A method according to claim 21 wherein said other form of identification data **is social security data**.	As described above, claim 21 is invalid in light of the prior art. The use of social security numbers as a form of identification was not a new concept at the time of the Katz filings. For example, Mueller-Schloer discloses an automated system using social security numbers for identification: "Examples for the kind of information that may be stored and for the usage of such a personal data card are the following: (a) The PDC may be used as an electronic ID card containing personal data such as name, date and place of birth, height, Social Security Number, driver's license information, passport number, and address." (Col. 1, Lines 39-42).

Claim 21, 23, 25, 26, 43, 45: U.S. Patent No. 6,292,547

Claim 45	**The Prior Art – Perdue, Robert J. and Eugene L. Rissanen. "CONVERSANT 1 Voice System: Architecture and Applications." Sept. / Oct. 1986**
A method according to claim 21 wherein the callers **order multiple items** during the course of a call.	As described above, claim 21 is invalid in light of the prior art. Perdue discloses a stock quotation system in which callers can order information about a variety of stocks. As seen in Table 1. on p. 43, the caller is able to receive multiple orders of stock information.

Claim 21, 23, 25, 26, 43, 45: U.S. Patent No. 6,292,547

Claim 45	**The Prior Art – Perdue, Robert J. and Eugene L. Rissanen. "CONVERSANT 1 Voice System: Architecture and Applications." Sept. / Oct. 1986**
A method according to claim 21 wherein the callers **order multiple items** during the course of a call.	As described above, claim 21 is invalid in light of the prior art. Perdue discloses a stock quotation system in which callers can order information about a variety of stocks. As seen in Table 1. on p. 43, the caller is able to receive multiple orders of stock information.

6651EU 1420260

AT&T's CONVERSANT™ I Voice System

This new voice response system, with its many telephone trunk interfaces, is targeted for the growing market of automated information services uses.

John P. Moosemiller
Member of Technical Staff
AT&T Bell Laboratories
Columbus, OH

IN SEPTEMBER 1985, AT&T Conversant Systems introduced the CONVERSANT™ I Voice System, a voice response and speech recognition product for the growing market of automated information services. This system accesses data bases via the public telephone network. Telephones, rotary or touch-tone, can become instant terminals eliminating the need for costly computer peripherals and providing easy availability.

The CONVERSANT I has many speech capabilities. Callers access the system through touch-tone signals, speaking isolated words and connected digit strings, or by using modems and data terminal equipment. The system responds with high-quality, natural-sounding speech using an advanced speech coding algorithm developed by AT&T.

CONVERSANT I applications include the following broad areas of information dissemination:

- financial services
- credit authorization
- wholesale and retail distribution
- sales order entry
- direct marketing
- transportation scheduling and dispatching
- college registration
- communication services

Hardware Architecture

The hardware architecture for the CONVERSANT I is flexible, expandable, and modular. It allows one to economically configure just the necessary voice channel capabilities. Additionally, the system controller and the voice switch can allocate speech processing units as needed, thus time-sharing them. For example, a catalog service user may log in with tone or speech recognition, download accumulated orders from a hand-held terminal to a system modem, leave a voice message for a supervisor via the real-time voice coder, and finally dial an attendant dispatcher, all within one use. It can be packaged from four to 80 channels.

The controller (Fig. 1) executes system software under the UNIX™ operating environment. Through this, local control of transactions is accomplished, along with substantial off-loading of host processing. Winchester disks provide ample storage for local data bases, coded speech, and system software. For reliability, these disks may be duplicated. Multiple data communication ports provide common data link protocols, including IBM 3270 BSC and SNA, and asynchronous ASCII TTY. The system controller communicates to intelligent and relatively autonomous speech subsystems via the IEEE 488 General Purpose Interface Bus (GPIB).

An internal voice switch supports the bridging of speech units to each incoming voice channel. One-to-many connections are possible. Four-wire continuity is preserved, permitting speech units to separately modify the signal gain for incoming and outgoing voice channels. The voice switch (Fig. 1) is the key to real-time allocation of speech processing hardware, which occurs under direction of the system controller via the GPIB. Simple system configurations, however, can make the voice switch unnecessary. For example, Fig. 1 shows voice response units directly connected to incoming trunk channels. Any speech processing units may be optionally bridged to incoming calls via the voice switch.

Most voice response systems only provide line interfaces to the telephone network, whereas the CONVERSANT I system adds many common trunk interfaces. Call supervision, the immediate knowledge of call progress and termination, is important for effective management of telecommunication costs and is possible only with trunks. The Dialed Number Identification Service (DNIS) has been used with a Direct Inward Dialing (DID) trunk interface to receive dialed digits as part of the call setup protocol. This allows advance classification of incoming calls for different applications which are greeted by appropriate transaction prompts. The DNIS feature is useful for service bureaus or for multiple-user applications.

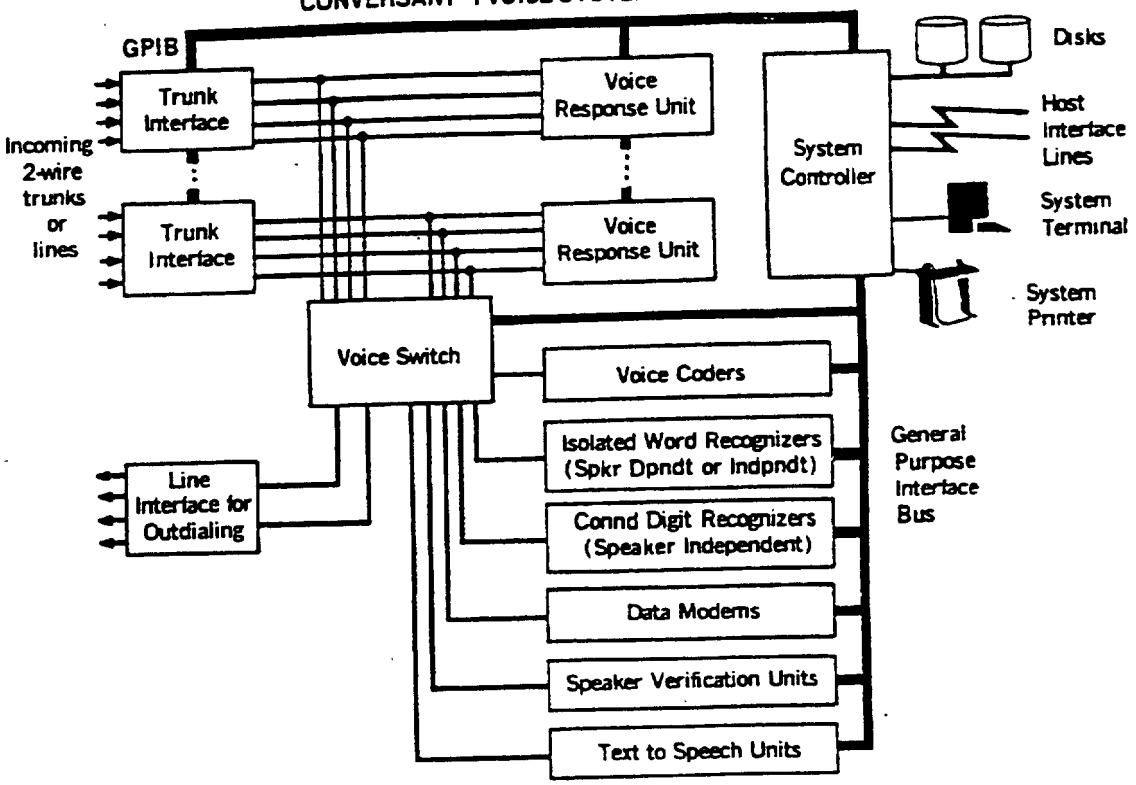
Most common analog trunk types and T1 digital carriers can be serviced through the system's telephone network interfaces. The system can dial out on lines and two-way trunks, and it can work in conjunction with Automatic Call Distributor and Private Branch Exchange systems. With direct trunk connections, though, the cost of the latter approach may be unnecessary.

The hardware architecture also allows for control of the speech subsystems and all subunits, including the switch and the network interfaces. This is done by the system controller using the GPIB. The following example illustrates this.

The trunk interface answers an incoming call and communicates this to the system controller via the GPIB. Transaction software determines what greeting phrase to play. This is followed by a prompt to dial "1" for tone input, the voice response unit is attached if not already dedicated, and commanded to play the phrases and collect touch-tone signals. If no tones are heard, the unit signals the controller over

Fig. 1

CONVERSANT™I VOICE SYSTEM ARCHITECTURE



the GPIB and it dictates the switch to bridge on a speech recognizer. The transaction continues to use the voice response unit to generate prompts and the speech recognizer to accept the user's voice commands. Transaction control and the speech subsystems management are performed by the system controller through the GPIB.

Design and Features

With the CONVERSANT I's flexible architecture, new features and channel capacity can be added as requirements change. It can operate standing alone or as a front-end processor to one or more host computers. The basic product uses touch-tone signaling and voice response. The internal voice switch bridges optional speech processing subsystems under direction of the system controller. Depending on the system's configuration, it can service up to 80 simultaneous calls and run different types of transactions concurrently.

Both telephone line and trunk interfaces are available, the latter providing direct call progress and supervision as part of the protocol exchanged with a central switching office. The system is capable of outdialing, bridging to an attendant for help or completing a partially automated transaction. In addition, CONVERSANT I's real time voice coder allows customers to record daily messages and make minor response changes conveniently on site. The system can also support voice mail.

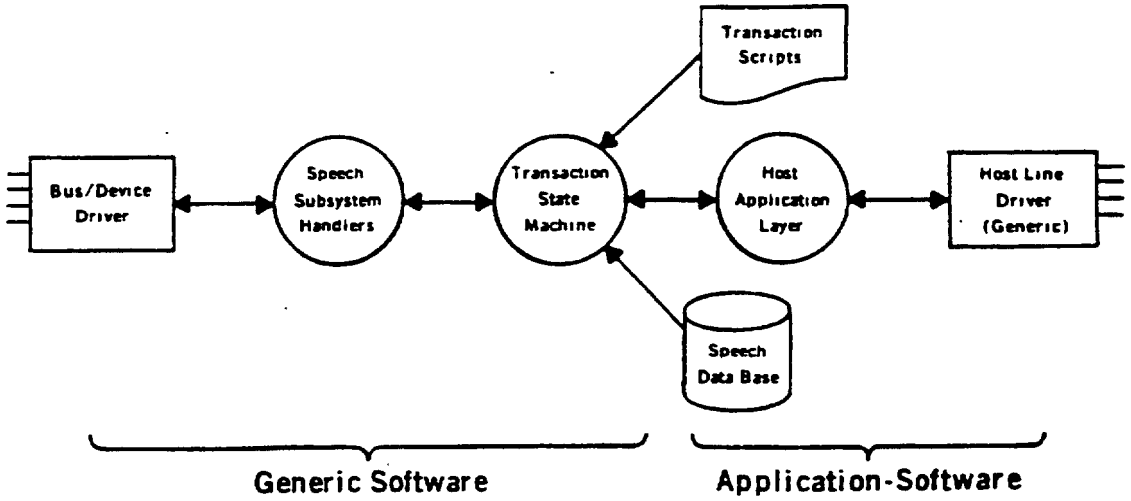
Voice recognition can be added to the basic product. Speaker independent and dependent recognition are available with both isolated and connected word capabilities. Automated services can be provided to rotary telephone users through speaker independent recognition of connected digit strings.

Features for reliability include backup disks, power supplies, and streaming tape drive. The system has built-in self diagnosis and will automatically reboot and recover if a severe operating problem is detected. Complete administrative and maintenance software tools are accessed through the system console or remote control.

When compared with traditional means of providing information services, the CONVERSANT I system is very cost effective. It reduces attendant costs through automation and provides revenue through new services that were previously uneco-

Fig. 2

CONVERSANT™1 SOFTWARE ARCHITECTURE



nomical.

Speech Processing Technologies

Three speech technologies—speech synthesis, recognition, and coding—are embodied in the CONVERSANT 1. High quality speech playback is accomplished efficiently using Multi-Pulse Linear Predictive Coding (MPLPC) algorithms developed at AT&T Bell Laboratories [1]. Good intelligibility is preserved at 9.6K bps, a rate compatible with the system's real-time voice coder. Studio quality occurs at rates approaching 14K bps. Each voice response unit has the capacity to store 400 seconds of MPLPC speech and virtually unlimited amounts of speech may be downloaded in real time from system disk storage. We have found that voice playback quality strongly influences users' perception of a service's worth. For this reason, our efforts have concentrated on synthesis by analysis of recorded speech, rather than synthesis by rule from text alone.

Both speaker independent and dependent speech recognition are possible, and isolated and connected utterances can be recognized. For speaker independent recognition, the vocabulary is currently limited to connected digit strings, isolated digits, and the words "yes" and "no." Robust recognition of telephone speech by the general public requires a substantial voice sampling effort [2].

Speech recognition is accomplished through statistical template matching with Dynamic Time Warping (DTW). AT&T Bell Laboratories has researched these algorithms for some time [3]. In addition, acoustic phonetic algorithms enhance the decision process and identify words within connected speech. Since the transmission bandwidth of telephone networks is only about 3.3 kHz, telephone speech is first sampled at a frequency of 6.6 kHz. Front-end processing of the speech signal involves an 8-pole auto-correlation analysis which results in an efficient representation called Linear Predictive Coding (LPC). Recognition occurs by comparing LPC coefficients for the speaker's utterance—called the test template—with LPC coded words in the data base—the reference templates. Within thresholds, the unknown word is assumed to belong to the same class as the set of templates it most closely matches using Itakura's distance metric [4].

For many applications, such as voice mail, daily announcements, and feedback of speaker-dependent command words, it is desirable to provide real-time voice coding. The CONVERSANT 1 satisfies this need with a voice coder that converts an analog speech signal into 9.6K bps MPLPC in real-time. The converted speech may be stored in digital format on the system disk and played back through the voice response unit immediately or later.

Future Speech Technologies

Two other related technologies, speaker verification and text-to-speech synthesis, are under investigation. The first is an automatic means of confirming the identity of a claimant based on historical speech patterns. This capability exists as a working prototype. Second, text-to-speech, or rule-based synthesis from text, is necessary for applications with open-ended vocabularies, such as proper names and addresses. AT&T Conversant Systems is monitoring research that promises to advance text-to-speech performance, such as efforts to devise better pronunciation rules for foreign words in an English context. When significant improvements in text-to-speech are possible, AT&T Conversant Systems will incorporate them in the CONVERSANT 1 product. In the mean-

ume, they will consider integrating other commercial text-to-speech units.

Application Software

Application software development may be done by AT&T Conversant Systems, a value-added reseller of the product, or the user. To facilitate development, clear delineations have been made between generic operational software and application software. In what follows, software architecture will be discussed in three areas: 1) applications development, 2) high-level script language used to define transactions, and 3) AT&T's experience in prototyping applications.

■ Development

A simplified view of the CONVERSANT I's software architecture emphasizing the customizable parts for applications, is shown in Fig. 2. Central to the architecture is the transaction state machine (TSM) which, through a single process, controls all active sessions. Although the TSM is generic, it interprets transaction scripts. Many different scripts may reside in the system and be executed concurrently. Which script to run is determined by the telephone number that was dialed, the physical telephone circuit on which the call was received, or further interaction with the user (scripts can transfer control to other scripts). The TSM controls all speech subsystems through various handlers and drivers. The applications programmer does not have to know how these devices work; they exist only as logical entities implied by the functionality of the script language.

The application programmer is responsible for the host application layer. Interactive communication with an external host computer is typical, but not absolutely necessary since the application may access a local data base on the system disk. Either way, some modules must be developed to process the content of data messages supporting the application. It is possible to place all information in the transaction script when prototyping applications. Currently, the host application layer must be written as C language subroutines. The developer, however, does not have to be concerned about lower-protocol layers because they are handled by generic host drivers.

Although not strictly software, the speech data base, which prompts the end user or verbalizes retrieved information through the voice response units, must be considered part of the application. The transaction script language has built-in knowledge of how to access the speech data base and is acted upon by the TSM.

■ Transaction Script Language

AT&T Conversant Systems has developed a high-level language for defining transaction scripts, thus making it easy to prototype speech applications and maintain them. The script language lets the application developer treat the TSM as a virtual machine. Device control details are hidden and automatically managed.

Instructions in the TSM script language were designed specifically for voice transactions. They include voice response instructions that speak phrases, numbers, and characters—in sensible ways with flexible intonation. Other instructions collect the user's speech or touch-tone signals or mediate data base transactions with a remote host computer. The following example illustrates logging into a service by voice entry of a numeric ID.

```
SCRIPT INSTRUCTION                      COMMENTS/ANNOTATION
MAIN:
  tfile ("/talk/script1")               /*talk phrase xref file */
  LOGON ( )                             /*call LOGON subroutine */
  SERVICE ( )
  BYE ( )
LOGON:
  talk ("hello, welcome")               /*say greeting phrase */
  talk ("please speak id")              /*prompt for verbal input */
  getdig (DIG9, ch.LOGID,9)             /*collect 9-digit response */
  dbase (0, VERIF, ch.RESP,
    RESPLEN, ch.LOGID, LOGLEN)          /*verify host 0 data base */
  jmp (r.0 < im.0 no reply)             /*timeout on host? jump */
  talk ("account verified for")
  tchars (ch RESP)                      /*confirmation string */
  rts ( )                               /*subroutine return */
SERVICE.
  rts ( )                               /*details not shown */
NO REPLY
  talk ("sorry, service is unavailable, try later")
BYE.
  talk ("thank you for calling")
  quit ( )
```

The flexible architecture of the CONVERSANT I system makes instructions for allocating devices appropriate. For example, a speech recognizer may bridge on only if the caller does not have a tone signaling telephone. Additional instructions for flow control and data manipulation provide a complete programming environment.

Using the high-level TSM script language, we have repeatedly implemented complex transaction sessions in a few pages of textual instructions. It has also been shown that transaction software written in the C language can be converted to script format with a resultant compression factor of 10 or more. Mnemonics are employed throughout scripts to reference encoded speech files, data structures, and subroutine labels. Because of these factors, the transaction script language is an effective tool for application developers and a

readable and maintainable definition of the application.

■ Prototyping

AT&T Conversant Systems has developed applications by *first prototyping* them. This is done by quickly generating a transaction script that simulates the initial concept, complete with dialog, but with little or no host application layer. By prototyping, the customer receives early exposure to the target transaction. It provides an easy way of retrying the simulation until it is substantially correct. The applications AT&T Conversant Systems has prototyped include stock quotations, catalog ordering, airline reservations, dial-it information menus, caller destination control, and telephone banking.

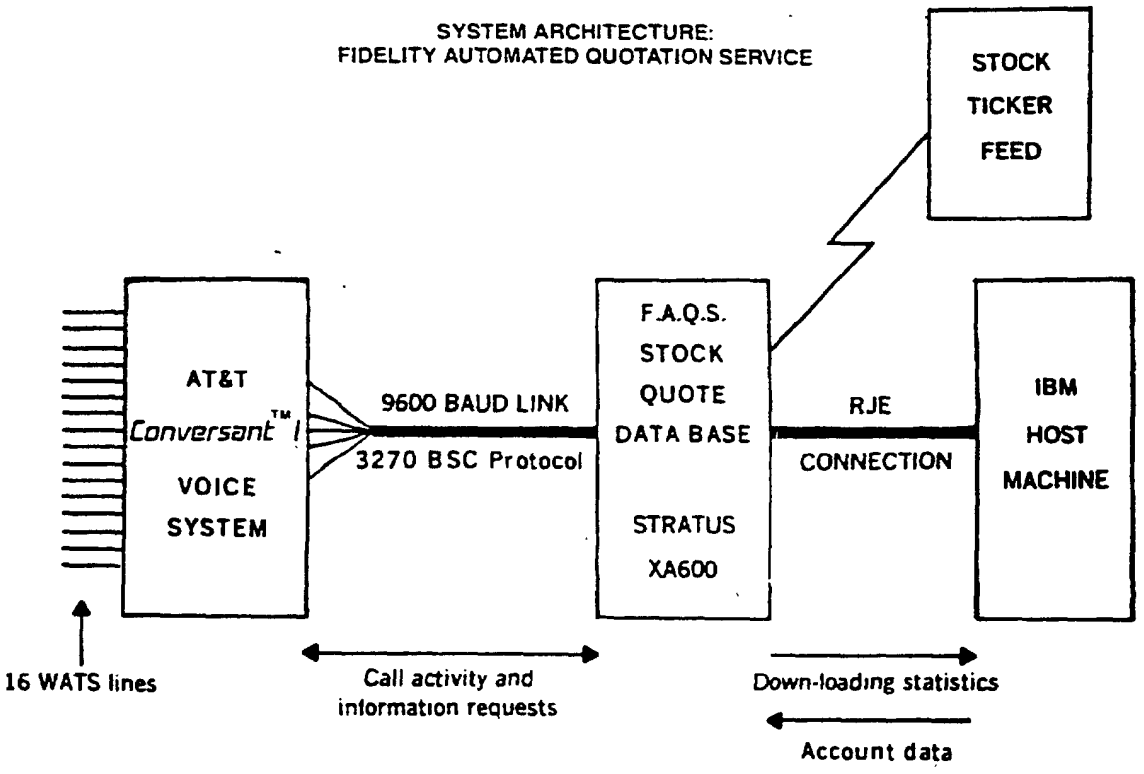
Several considerations go into prototyping and application development. Most important, though, is the user model. Successful implementation of the application depends upon three factors:

- easy access and utility
- adequacy and necessity of information provided
- minimal connect time

The last attribute is important to the service provider because it reduces telecommunication costs. It is also significant to the end users who weigh their time against alternative sources of information. In assessing application success, one must bear in mind the end user's short-term memory capacity and how information processing restraints affected it. For instance, input prompts should state or strongly imply the valid responses, such as "yes" or "no," at the end of the message. Retrieved data, such as numbers that must be spoken as a series of individual words, may be unintelligible if attention is not given to prosody (rhythm) and intonation. Poor intelligibility increases the information processing load on the user and reduces attention to the main task. The transaction script language aids prototype development by providing built-in intonation and pronunciation rules for numeric and character strings.

Once the application concept is defined, a familiar series of steps result in functional data requirements, flow diagrams, and transaction dialog. Prototyping gives the developer early feedback on human factors of a voice transaction without having to fully implement data base interfaces and error handling.

Fig. 3



Stock Quotation Application

One application in use is AT&T Conversant Systems support of a stock quotation service for customers of Fidelity Brokerage Services, a major discount brokerage house in Boston. This represents the first commercial application of connected speech recognition in support of automated delivery of information services by telephone.

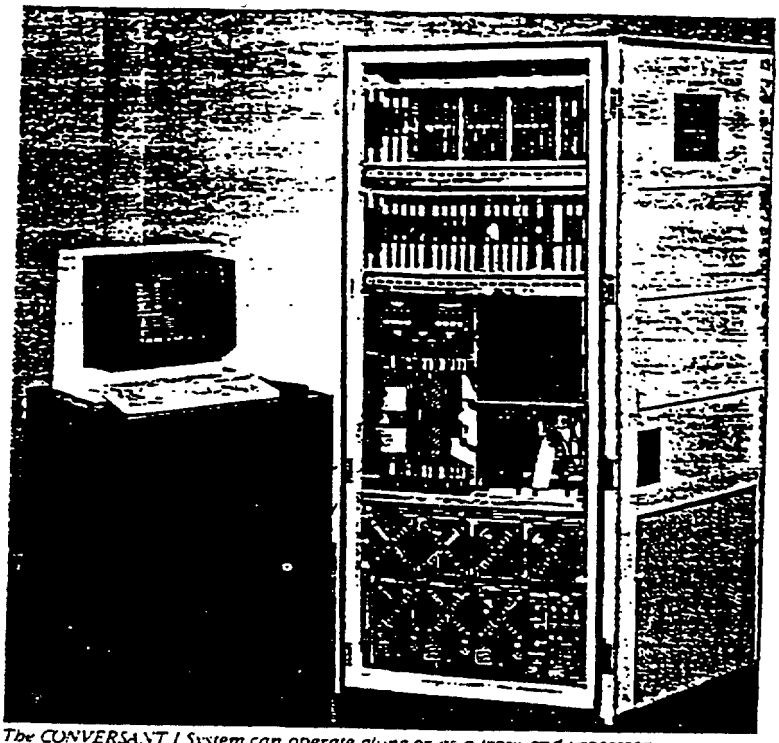
In this application, the CONVERSANT I is a front-end processor to the service provider's quotation data base and a host computer with customer account information, as shown in Fig. 3. The service provides on-demand quotations for 6000 stocks, stock option quotations, a personal stock watch list for convenience, and the current Dow Jones Industrials Average. Transaction control is provided locally in the CONVERSANT I, that is, it determines how many quotes to provide per call and when to provide help messages. Only a few, carefully defined messages need be exchanged with the data base machine to support the application, and they are strictly informational messages. They accomplish the following:

- LOG—validates user ID number, returns stock watch list
- DOW—returns Dow plus time and date
- STK—accepts stock number, then outputs ticker symbol, and quote
- OPQ—accepts option number with its month and strike price codes, outputs option quote
- OFF—logs off; confirmation for each user session
- STA—uploads accumulated system transaction statistics

By offloading transaction control, the data base host can perform more effectively. The host also supports a personal computer service separate from this application. A multi-threaded data stream arrangement allows only a few physical lines to handle a much larger number of active sessions. The CONVERSANT I treats the data base host as an individual transaction server while also managing user sessions with its built-in state machine.

The user's contact with the quote service depends on a catalog which gives stocks numeric IDs. Current speech recognition capability permits nine-digit encoded strings made up of the words "one" through "nine" to map to stock items with a string accuracy greater than 95 percent. Redundancy and error correction are built into the coded strings. This numeric catalog approach has widespread applicability in the areas of order entry, menu selection, and information retrieval.

Fig. 4



The CONVERSANT I System can operate alone or as a front-end processor to one or more host computers.

Marketing Outlook

Since the AT&T CONVERSANT I voice system provides conversational access to computer information from any telephone, it is flexible and efficient in supporting a range of input and output modalities. By marketing it through a variety of channels, AT&T plans to develop complete application solutions for business customer problems that arise.

REFERENCES

1. B. Atal, "Predictive Coding of Speech at Low Bit Rates," IEEE Trans. *Communications* COM-30, 1982, pp. 600-614.
2. S.D. Hester, H.M. McHugh, K.A. Vander-Meulen, "The AT&T Multi-Mode Voice Systems—Full Spectrum Solutions for Speech Processing Applications," *Proceedings of the 1985 AVIOS Conference*.
3. L.R. Rabiner and C.E. Schmidt, "Application of Dynamic Time Warping to Connected Digit Recognition," IEEE Trans. *Acoustics, Speech and Signal Processing* ASSP-28, 1980, pp. 377-388.
4. F. Itakura, "Minimum Prediction Residual Principle Applied to Speech Recognition," IEEE Trans. *Acoustics, Speech and Signal Processing* ASSP-23, 1975, pp. 67-72.

FOR MORE INFORMATION

Contact Chris D. Farrar, AT&T Conversant Systems, 9200 East Broad Street, Columbus, OH [illegible].

COPYRIGHT
FEE PAID

This document has been supplied by or on behalf of
The British Library Document Supply Centre,
Boston Spa, Wetherby, West Yorkshire, LS23 7BQ
UNITED KINGDOM

WARNING Further copying of this document
including storage in any medium by electronic means
other than that for which it was supplied is only per-
mitted with the permission of the copyright owner or an
authorised licensing body.

069240-0101-MMcN/002

Scanned with CamScanner

United States Patent [19]

Bestler et al.

[11] **Patent Number: 4,755,872**

[45] **Date of Patent: Jul. 5, 1988**

[54] **IMPULSE PAY PER VIEW SYSTEM AND METHOD**

[75] Inventors: **Charles B. Bestler**, Oak Park; **Gordon E. Reichard, Jr.**, Rolling Meadows; **Thomas J. Rossen**, Oak Park; **Semir Sirazi**, Chicago, all of Ill.

[73] Assignee: **Zenith Electronics Corporation**, Glenview, Ill.

[21] Appl. No.: **760,218**

[22] Filed: **Jul. 29, 1985**

[51] **Int. Cl.**[4] **H04M 11/08**; H04M 15/00; H04N 7/10; H04H 9/00

[52] **U.S. Cl.** **358/86**; 379/105; 379/246

[58] **Field of Search** ..... 179/2 A, 5.5, 18 FH; 358/84, 86, 349; 455/2, 4, 5; 379/102, 104, 105, 127, 142, 246

[56] **References Cited**

U.S. PATENT DOCUMENTS

3,920,908	11/1975	Kraus .	
4,163,254	7/1979	Block et al.	358/84 X
4,460,922	7/1984	Ensinger et al.	358/122
4,518,989	5/1985	Yabiki et al.	358/86
4,536,791	8/1985	Campbell et al.	358/86 X
4,554,418	11/1985	Toy .	
4,558,464	12/1985	O'Brien, Jr.	358/86 X
4,590,516	5/1986	Abraham	358/86

FOREIGN PATENT DOCUMENTS

103438	3/1984	European Pat. Off.	358/86
217308	4/1987	European Pat. Off. .	
WO85/03830	8/1985	World Int. Prop. O.	84/
WO87/04884	8/1987	World Int. Prop. O.	358/86

OTHER PUBLICATIONS

The Yankee Group, "Cable and the Telcos: from Confrontation to Détente," Jun. 1983, pp. 162-167.

A. F. Bulfer, "Dial-A-View," talk given at the Motion Picture Industry Seminar, Dec. 3, 1984, Los Angeles, Ca.

Bulfer et al., "A Trial of a National Pay-Per-View Ordering and Billing System," NCTA Technical Papers, Cable 86, Dallas Tex., Mar. 1986.

Zenith Electronics, "Advanced New Cable TV Technology Developed for Impulse-Pay-Per-View," Jun. 3, 1985, press release published by Zenith Electronics, Corp. Glenview, Ill., obtained from Dialog Data Base, 'File 621'.

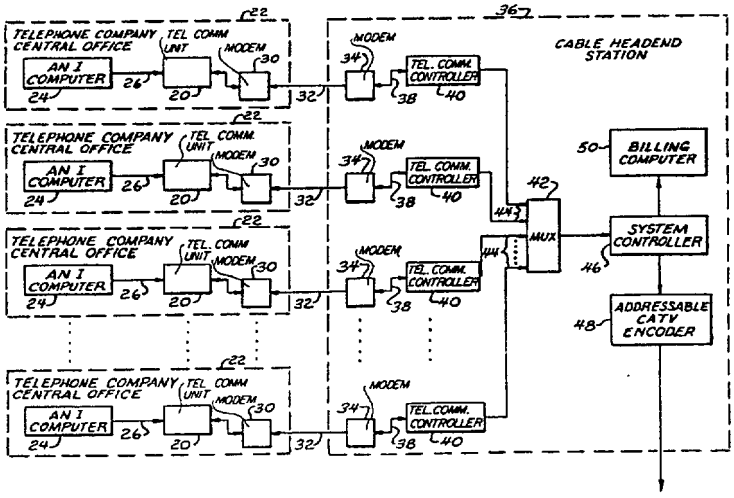
Sirazi et al., "Comparative Study of Hybrid IPPV Implementations" presented Jun. 3, 1985 at Cable 85, Las Vegas, Nv.

Primary Examiner—Keith E. George

[57] **ABSTRACT**

An IPPV technique is provided for a cable system having one-way addressable converters. Each of several central offices in a metropolitan area will provide ANI information representing the cable subscriber's phone number and a code representing the cable event to be viewed or cancelled. The data is sent asynchronously to a respective telephone communication unit located at the central office. This telephone communication unit (TCU) does some buffering, eliminates unnecessary data, and sends data synchronously to a telepone communication controller (TCC) located at the cable headend station. The TCC will acknowledge the data. There will be several TCCs located at the cable headend station corresponding to the several central offices who may give telephone service to the cable operator's subscribers. All of these TCCs at the headend station are coupled through a multiplexer to a system controller. Each TCC provides intermediate processing which converts the subscriber's telephone number into binary. The multiplexer provides buffering, flow control, and arbitration among various TCCs. The multiplexer adapts to data flow conditions. The system controller receives data from each subscriber, locates a corresponding home terminal unit address, examines the password and other information, and maps the two digit program identification which was entered by the subscriber into an authorization code. It then authorizes the home terminal units in accordance with the IPPV requests by transmitting the subscriber's cable address and a new authorization code in the vertical blanking interval, generates the commercial transaction, and downloads the transaction to a billing system.

63 Claims, 12 Drawing Sheets



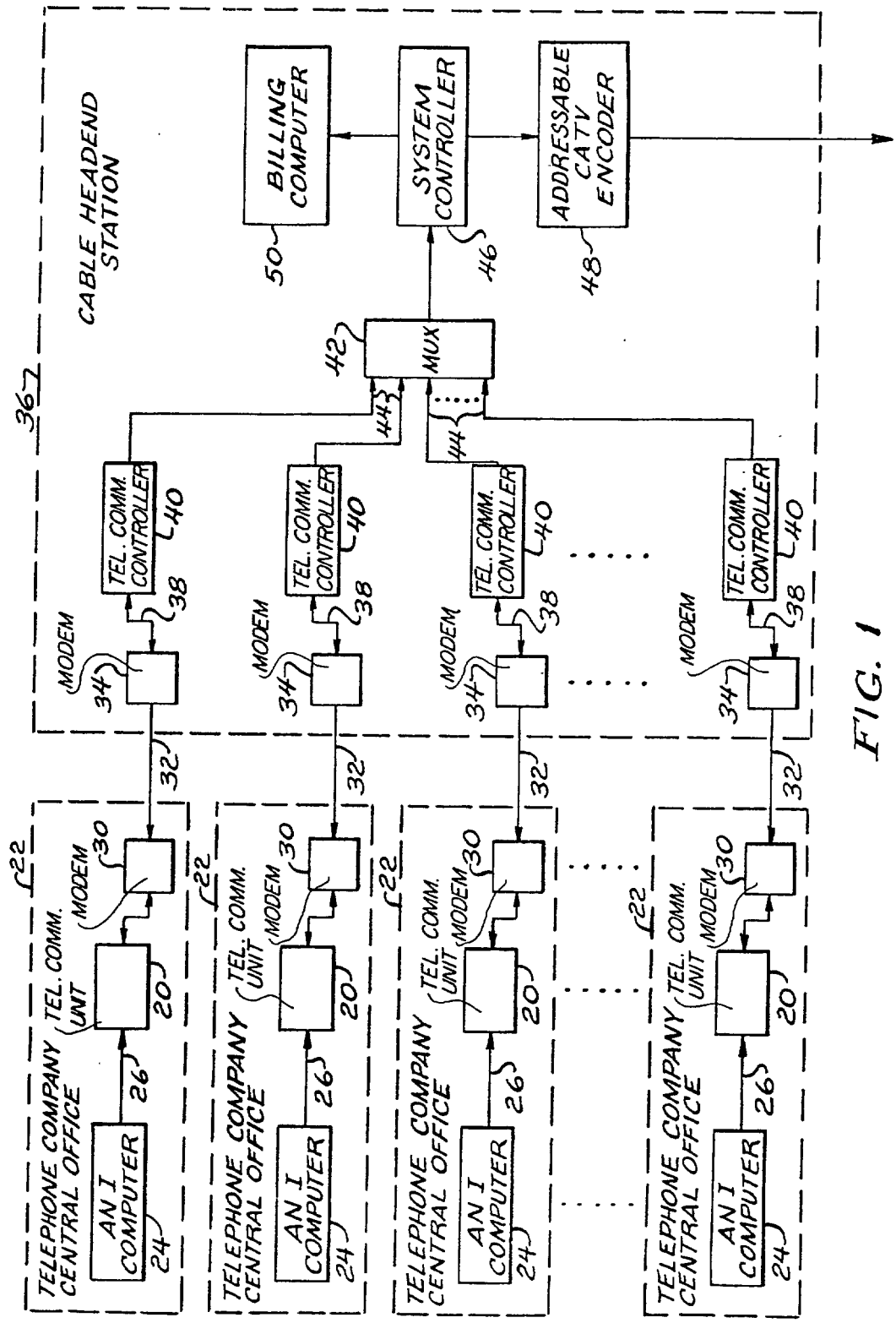

CABLE HEADEND STATION
36
BILLING COMPUTER
50
SYSTEM CONTROLLER
46
ADDRESSABLE CATV ENCODER
48
MUX
42
44
TEL. COMM. CONTROLLER
40
MODEM
34
38
32
TELEPHONE COMPANY CENTRAL OFFICE
22
TEL. COMM. UNIT
20
MODEM
30
ANI COMPUTER
24
26

FIG. 1

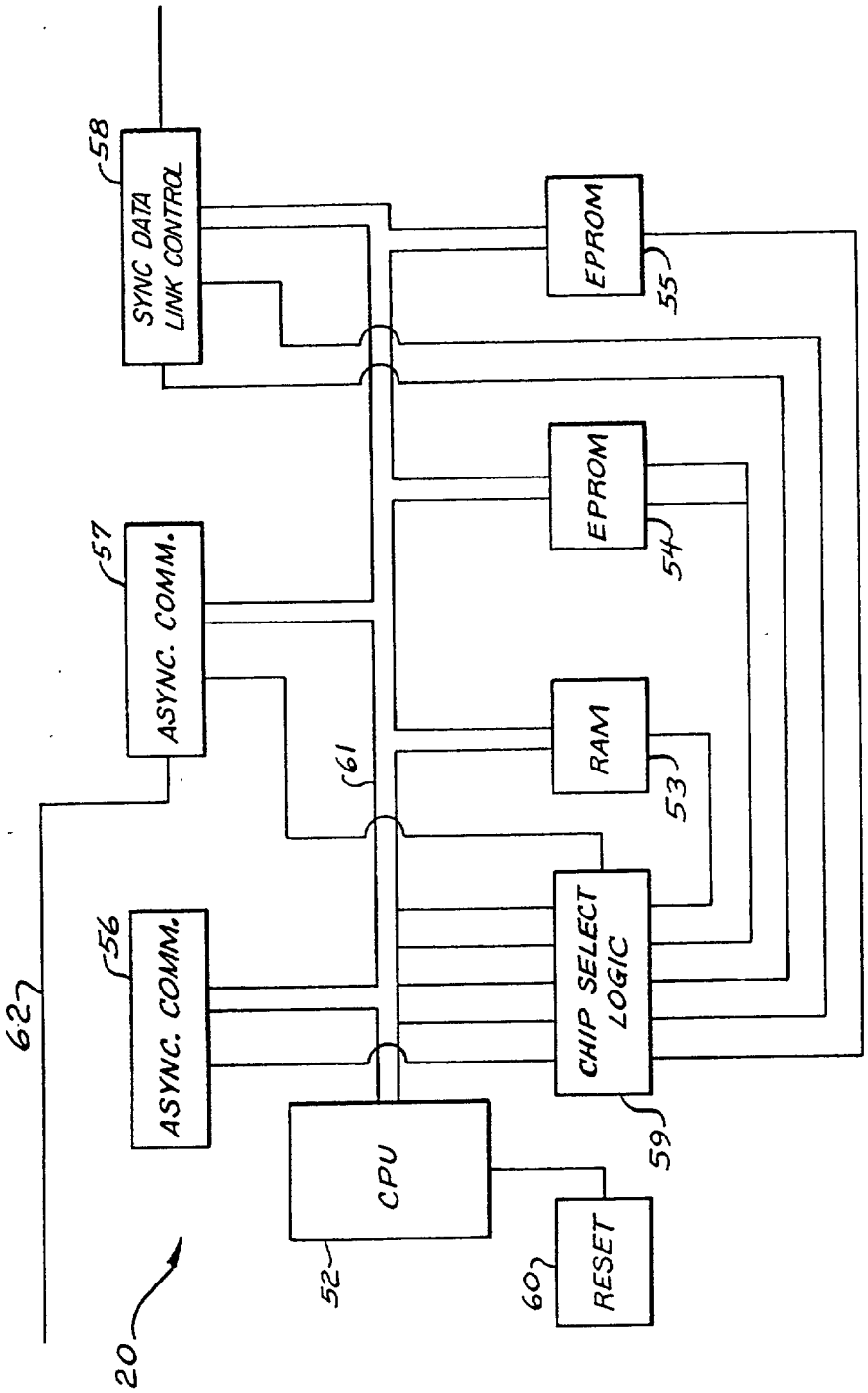
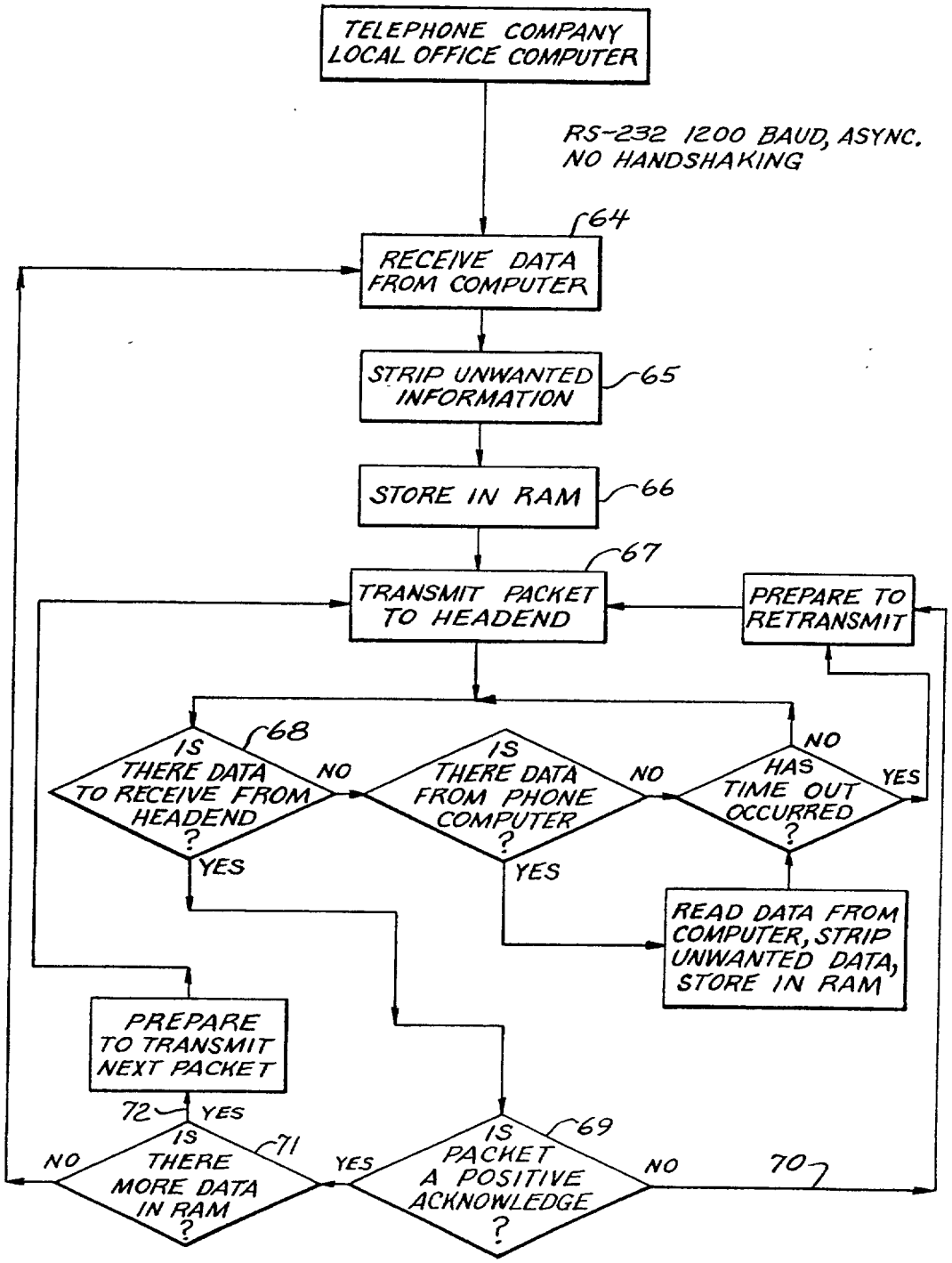

SYNC DATA LINK CONTROL
58
EPROM
55
EPROM
54
ASYNC. COMM.
57
RAM
53
61
ASYNC. COMM.
56
CHIP SELECT LOGIC
59
62
CPU
52
RESET
60
20

FIG. 2

FIG.3


TELEPHONE COMPANY LOCAL OFFICE COMPUTER
RS-232 1200 BAUD, ASYNC. NO HANDSHAKING
64
RECEIVE DATA FROM COMPUTER
STRIP UNWANTED INFORMATION
65
STORE IN RAM
66
67
TRANSMIT PACKET TO HEADEND
PREPARE TO RETRANSMIT
68
IS THERE DATA TO RECEIVE FROM HEADEND ?
NO
IS THERE DATA FROM PHONE COMPUTER ?
NO
HAS TIME OUT OCCURRED ?
NO
YES
YES
YES
READ DATA FROM COMPUTER, STRIP UNWANTED DATA, STORE IN RAM
PREPARE TO TRANSMIT NEXT PACKET
72
YES
IS THERE MORE DATA IN RAM ?
71
NO
YES
IS PACKET A POSITIVE ACKNOWLEDGE ?
69
NO
70

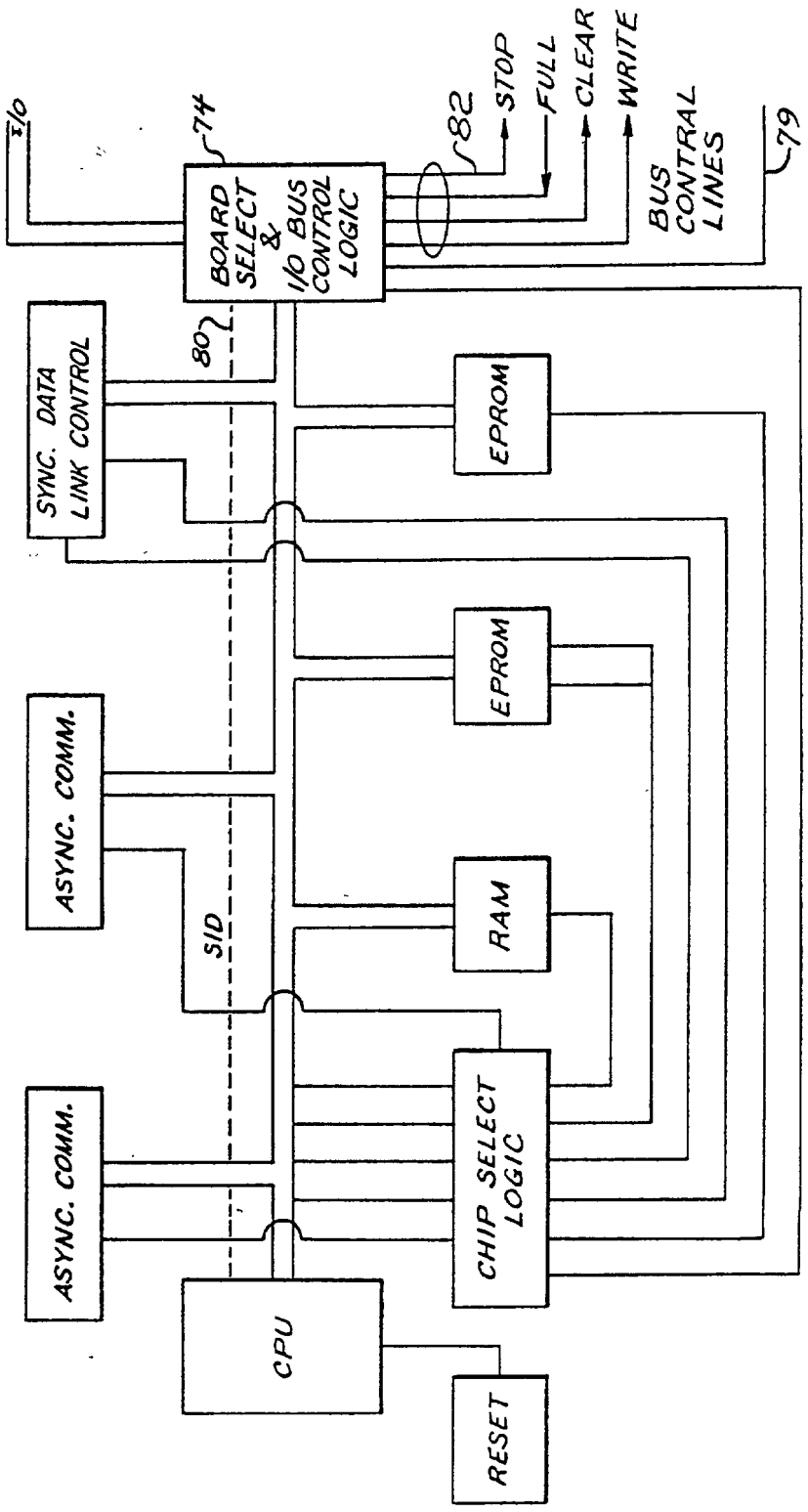

I/O
74
BOARD SELECT & I/O BUS CONTROL LOGIC
82
STOP
FULL
CLEAR
WRITE
BUS CONTRAL LINES
79
80
SYNC. DATA LINK CONTROL
EPROM
EPROM
ASYNC. COMM.
SID
RAM
ASYNC. COMM.
CHIP SELECT LOGIC
CPU
RESET

FIG. 4A

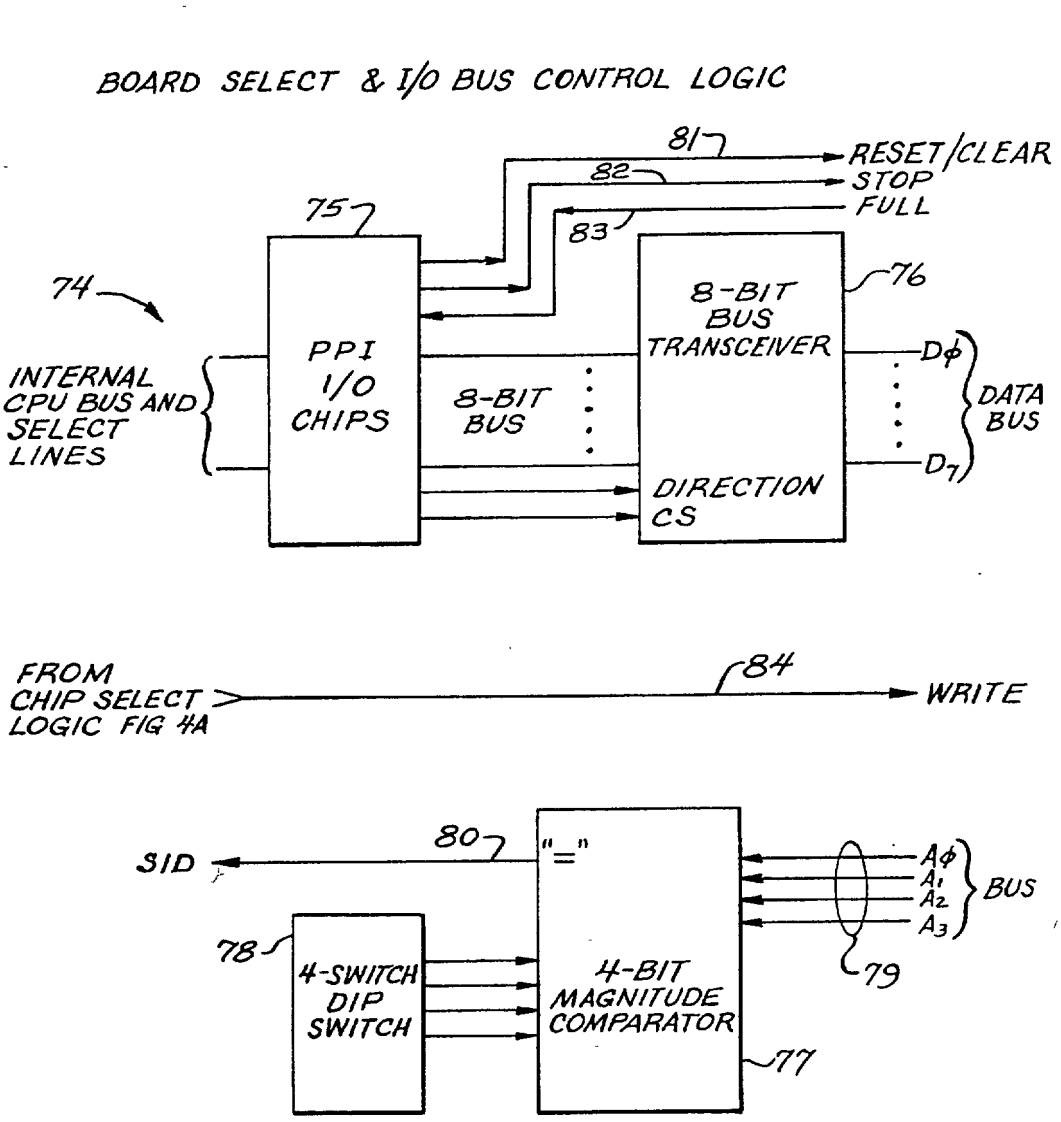

BOARD SELECT & I/O BUS CONTROL LOGIC
81
RESET/CLEAR
82
STOP
FULL
83
75
74
INTERNAL CPU BUS AND SELECT LINES
PPI I/O CHIPS
8-BIT BUS
8-BIT BUS TRANSCEIVER
76
DATA BUS
DIRECTION
CS
FROM CHIP SELECT LOGIC FIG 4A
84
WRITE
SID
80
"="
BUS
78
4-SWITCH DIP SWITCH
4-BIT MAGNITUDE COMPARATOR
79
77

FIG. 4B

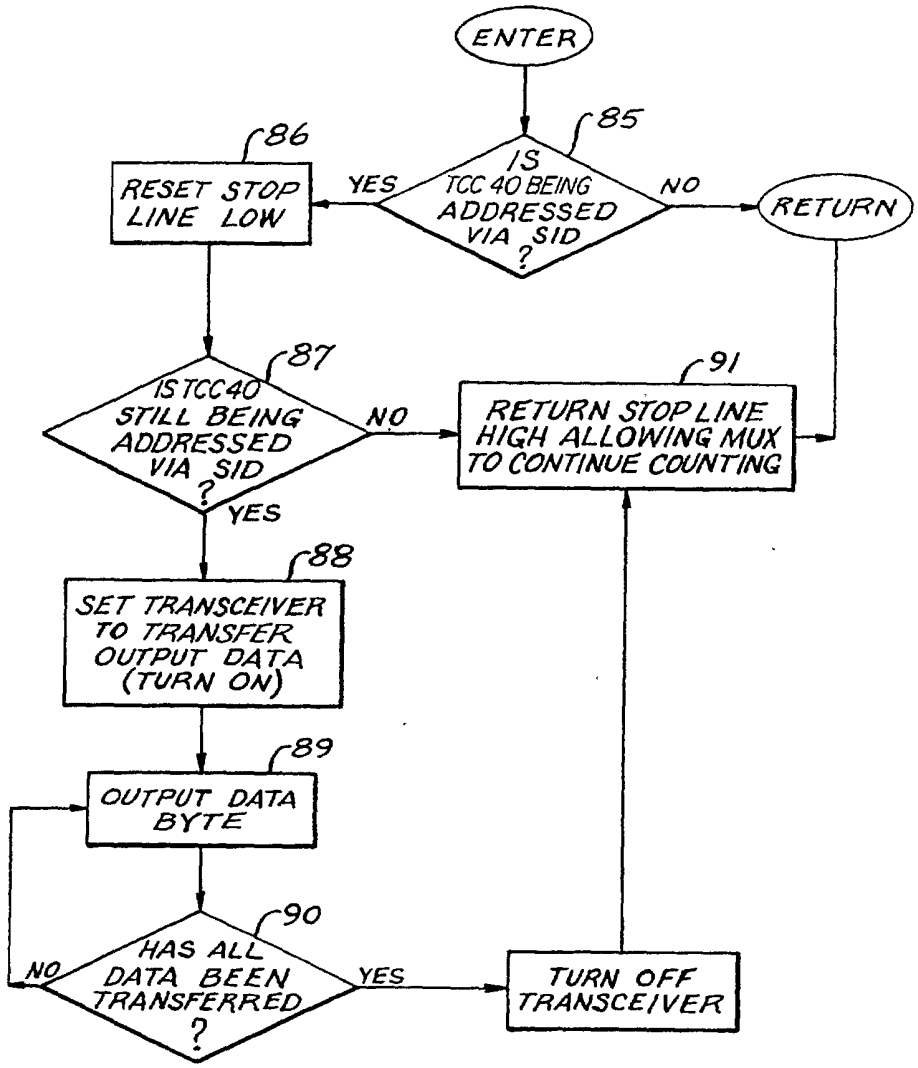

ENTER
85
IS TCC 40 BEING ADDRESSED VIA SID ?
YES
NO
86
RESET STOP LINE LOW
RETURN
87
IS TCC40 STILL BEING ADDRESSED VIA SID ?
NO
YES
91
RETURN STOP LINE HIGH ALLOWING MUX TO CONTINUE COUNTING
88
SET TRANSCEIVER TO TRANSFER OUTPUT DATA (TURN ON)
89
OUTPUT DATA BYTE
90
HAS ALL DATA BEEN TRANSFERRED ?
NO
YES
TURN OFF TRANSCEIVER

FIG. 4C

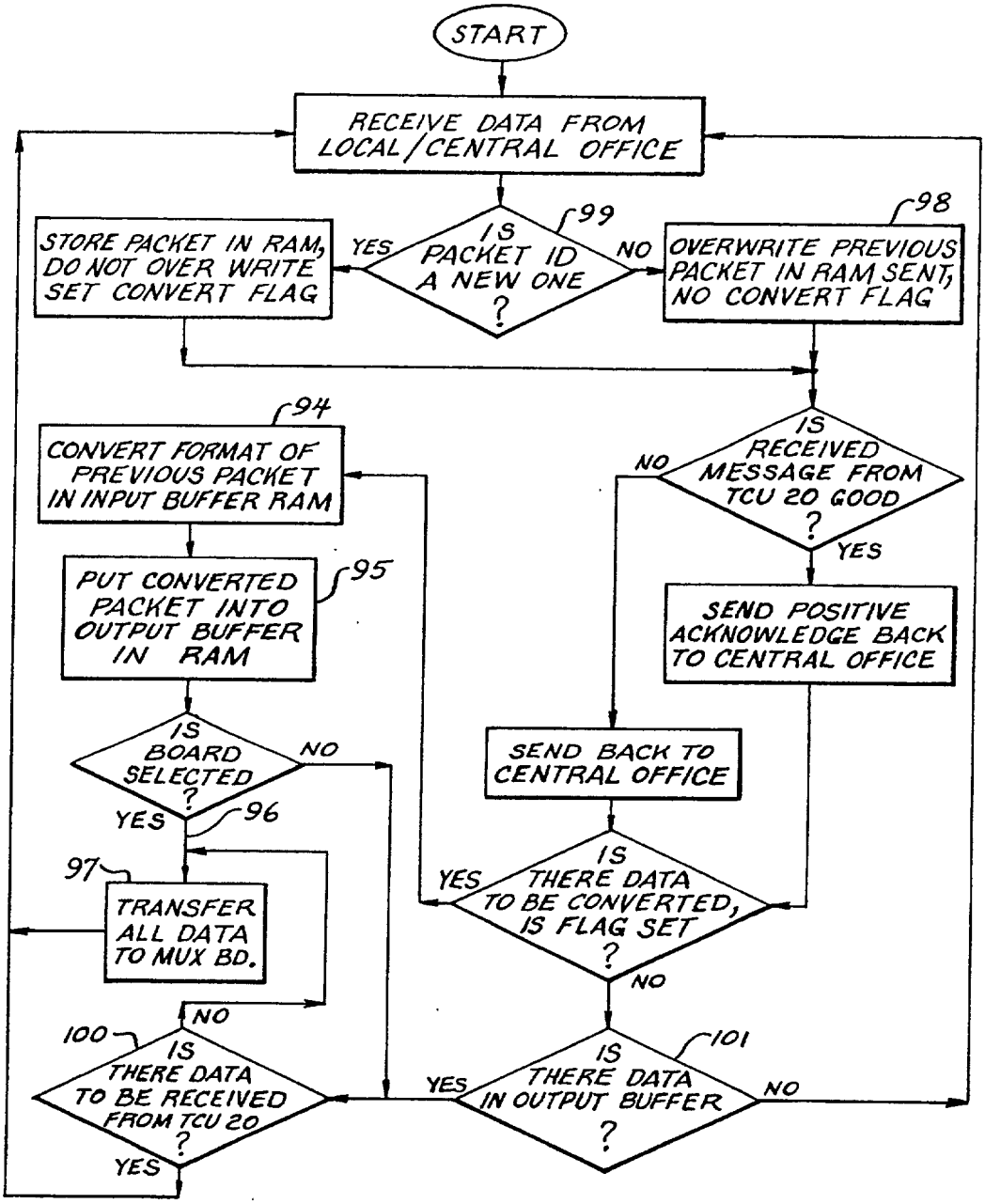

START
RECEIVE DATA FROM LOCAL/CENTRAL OFFICE
99
IS PACKET ID A NEW ONE ?
YES
NO
STORE PACKET IN RAM, DO NOT OVER WRITE SET CONVERT FLAG
98
OVERWRITE PREVIOUS PACKET IN RAM SENT, NO CONVERT FLAG
94
CONVERT FORMAT OF PREVIOUS PACKET IN INPUT BUFFER RAM
IS RECEIVED MESSAGE FROM TCU 20 GOOD ?
NO
YES
95
PUT CONVERTED PACKET INTO OUTPUT BUFFER IN RAM
SEND POSITIVE ACKNOWLEDGE BACK TO CENTRAL OFFICE
IS BOARD SELECTED ?
NO
YES
96
SEND BACK TO CENTRAL OFFICE
97
TRANSFER ALL DATA TO MUX BD.
IS THERE DATA TO BE CONVERTED, IS FLAG SET ?
YES
NO
NO
100
IS THERE DATA TO BE RECEIVED FROM TCU 20 ?
YES
101
IS THERE DATA IN OUTPUT BUFFER ?
YES
NO

FIG. 5

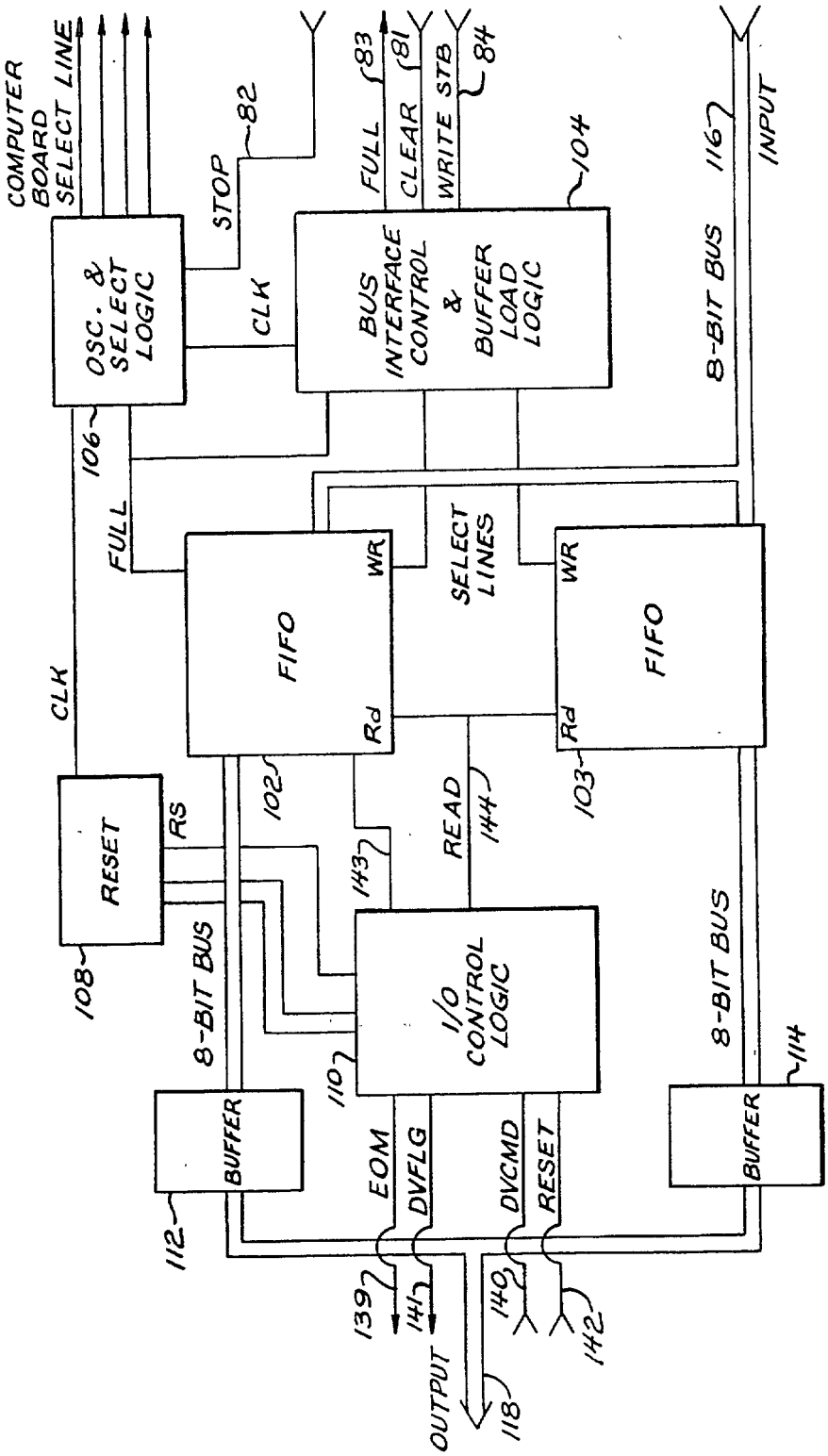

COMPUTER BOARD SELECT LINE
OSC. & SELECT LOGIC
106
STOP
82
CLK
BUS INTERFACE CONTROL & BUFFER LOAD LOGIC
104
FULL
83
CLEAR
81
WRITE STB
84
8-BIT BUS
116
INPUT
FULL
FIFO
WR
Rd
SELECT LINES
FIFO
WR
Rd
103
CLK
RESET
108
RS
102
READ
144
143
8-BIT BUS
I/O CONTROL LOGIC
110
8-BIT BUS
114
BUFFER
112
BUFFER
EOM
DVFLG
DVCMD
RESET
139
141
140
142
OUTPUT
118

FIG. 6A

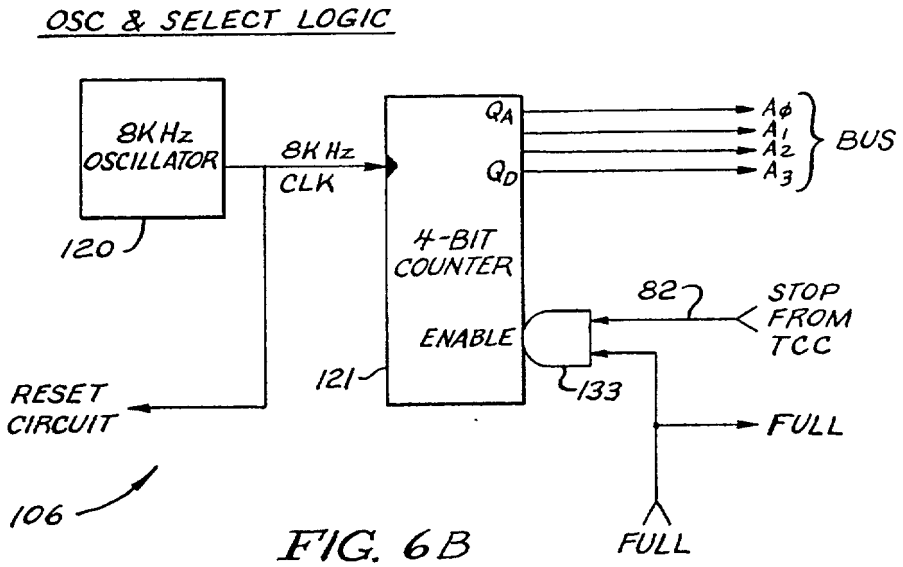

OSC & SELECT LOGIC
8K Hz OSCILLATOR
120
8K Hz CLK
Q_A
Q_D
4-BIT COUNTER
121
ENABLE
82
STOP FROM TCC
133
A_0
A_1
A_2
A_3
BUS
RESET CIRCUIT
106
FULL
FULL

FIG. 6B

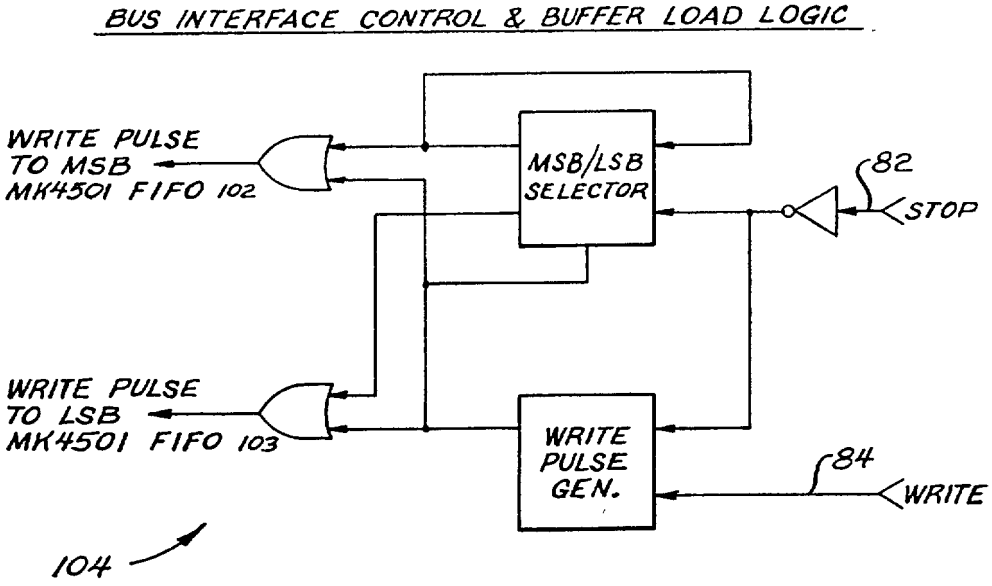

BUS INTERFACE CONTROL & BUFFER LOAD LOGIC
WRITE PULSE TO MSB MK4501 FIFO 102
MSB/LSB SELECTOR
82
STOP
WRITE PULSE TO LSB MK4501 FIFO 103
WRITE PULSE GEN.
84
WRITE
104

FIG. 6C

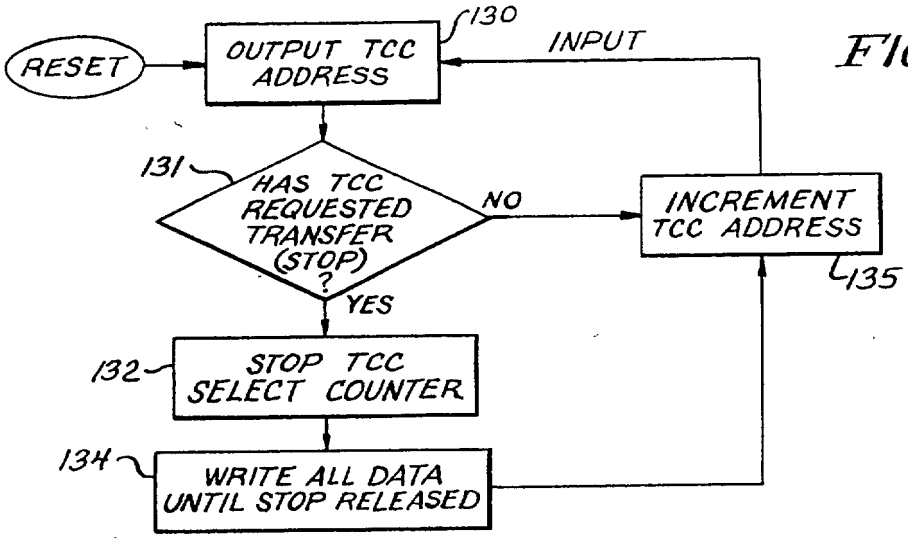


FIG. 7

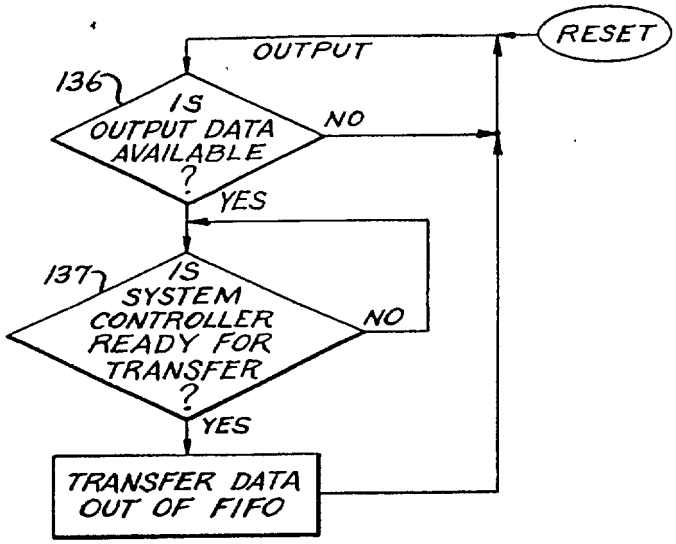
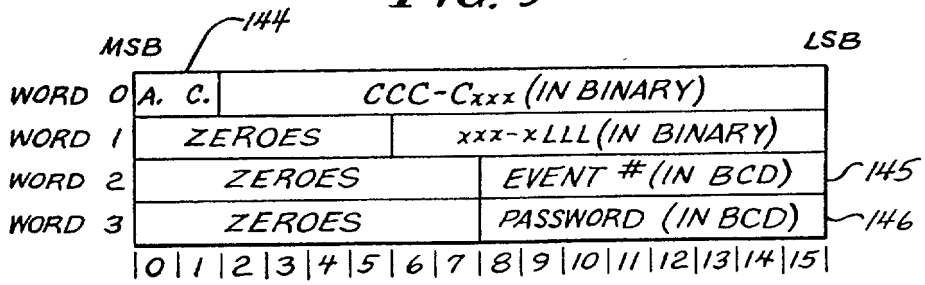


FIG. 8

FIG. 9



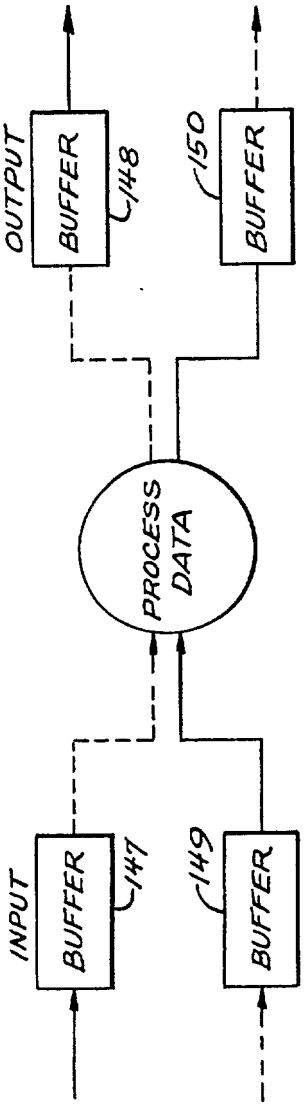

INPUT BUFFER
147
149
BUFFER
PROCESS DATA
OUTPUT BUFFER
148
150
BUFFER

FIG. 10

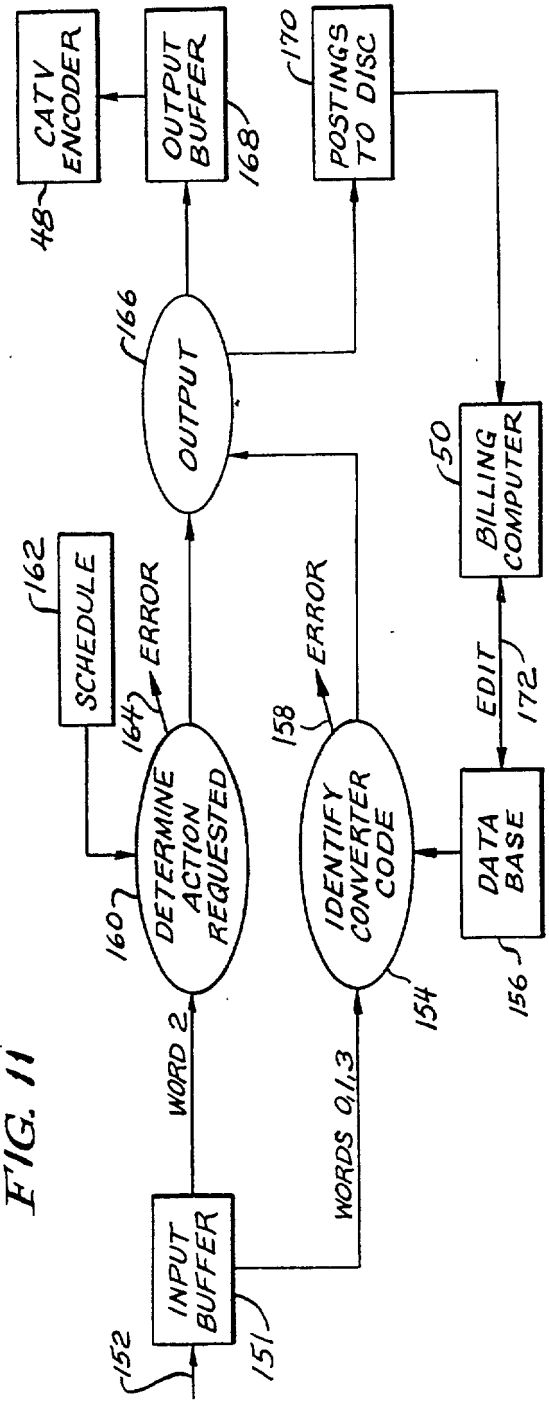

CATV ENCODER
48
OUTPUT BUFFER
168
POSTINGS TO DISC
170
OUTPUT
166
SCHEDULE
162
ERROR
164
DETERMINE ACTION REQUESTED
160
WORD 2
INPUT BUFFER
152
151
WORDS 0,1,3
IDENTIFY CONVERTER CODE
154
ERROR
158
DATA BASE
156
EDIT
172
BILLING COMPUTER
50

FIG. 11

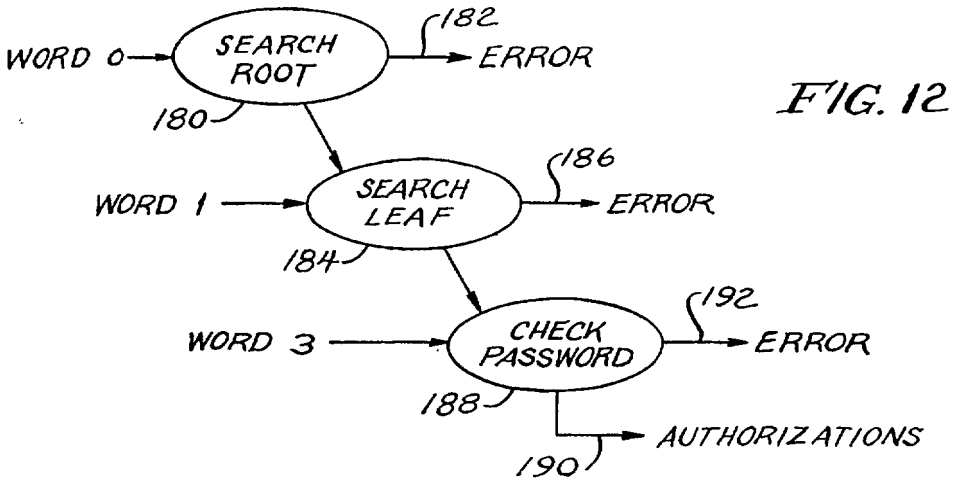

WORD 0
SEARCH ROOT
182
ERROR
180
WORD 1
SEARCH LEAF
186
ERROR
184
WORD 3
CHECK PASSWORD
192
ERROR
188
AUTHORIZATIONS
190

FIG. 12

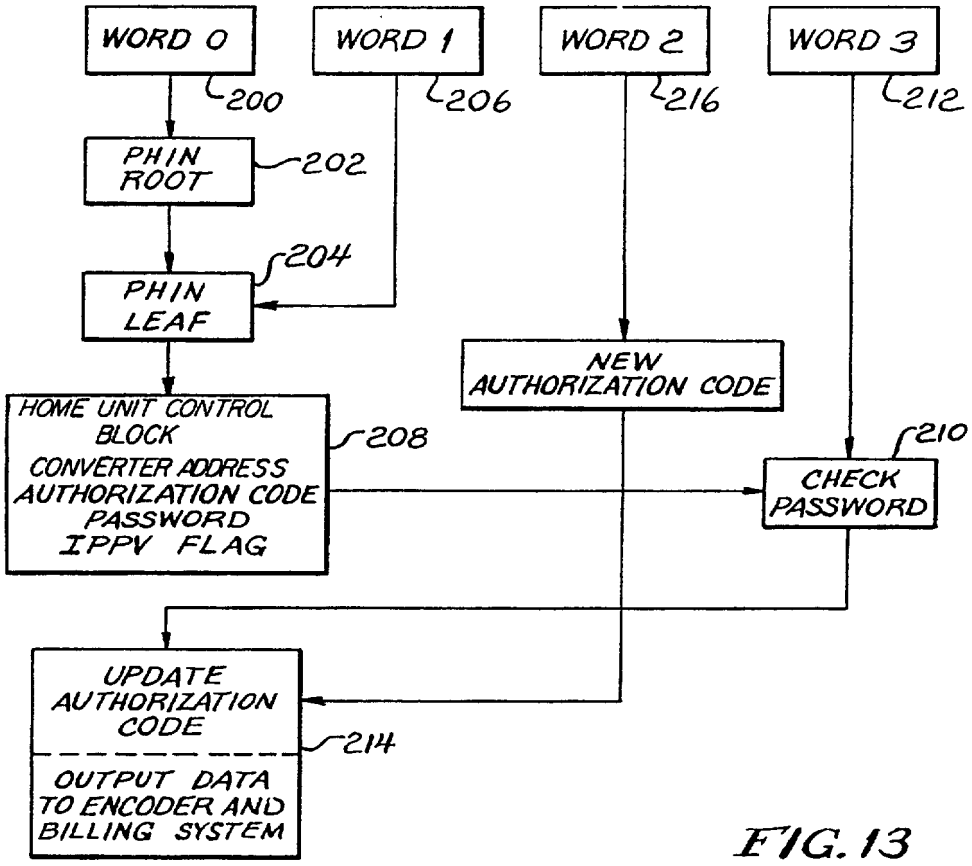

WORD 0
WORD 1
WORD 2
WORD 3
200
206
216
212
PHIN ROOT
202
204
PHIN LEAF
NEW AUTHORIZATION CODE
HOME UNIT CONTROL BLOCK
CONVERTER ADDRESS
AUTHORIZATION CODE
PASSWORD
IPPV FLAG
208
210
CHECK PASSWORD
UPDATE AUTHORIZATION CODE
214
OUTPUT DATA TO ENCODER AND BILLING SYSTEM

FIG. 13

IMPULSE PAY PER VIEW SYSTEM AND METHOD

BACKGROUND OF THE INVENTION

The present invention relates to cable television and particularly to a technique whereby a cable subscriber can send a request via telephone to the cable operator to receive only a selected cable program. This is known as an "impulse pay per view" system.

The preferred embodiment of the present invention is compatible with one-way addressable CATV systems. Prior to describing the invention, it will be useful to have a rudimentary understanding of a typical one-way addressable CATV system. In use, a cable operator at a "headend" station receives signals via satellite, microwave, and super trunks, encodes the signals, modulates them, and provides them to the cable plant. The cable plant is a distribution network typically carrying up to 80 channels or more over a distance of up to 20 miles or so to various subscribers. Each of the cable subscribers is provided with a one-way addressable converter (also called a decoder) which is connected to the cable and to a television receiver or monitor. The basic function of the converter is to interface the cable signals with the subscriber according to authorization codes received from the headend. The subscriber will select a channel containing a program desired to be viewed. The converter will determine whether that channel or program on the channel is authorized for viewing by the subscriber. If so, the converter descrambles the selected signal provided by the cable operator and provides a descrambled signal to the television receiver or monitor. The scrambling may, for example, be done by sync suppression wherein sync information is randomly suppressed, as well as video inversion.

To achieve the foregoing system, use may be made of the vertical blanking interval, e.g. line numbers **10, 11, 12** and **13**, or an out-of-band data channel during which information can be transmitted by the headend station to the subscribers or any selected subscriber. Each converter has a respective unique address code illustratively having 20 binary bits so that over one million subscribers can be individually addressed by the headend. Additionally, each converter typically includes a random access memory (RAM) which is capable of storing 20 bits, for example. Each of the stored bits is representative of a service or channel which may be subscribed to. Typically, at installation, the RAM is loaded with all zero bits. When the subscriber chooses the services he wants, that information will be entered as data in a subscriber data base. The subscriber data base is accessed by a system controller at the headend station which is capable of addressing any or all of the converters in the field. The system controller also communicates with a billing and management computer.

More particularly, in this example the system controller transmits a selected 20 bit address code (sometimes referred to as an "identification code") followed by an associated authorization code using each of line numbers **10, 11**, and/or **12** in the vertical blanking interval. Each converter receives the 20 bit address code, but only one converter will decode it as matching its own unique address. Following the transmitted 20 bit address code are the five bits of the authorization code. These five authorization bits will be loaded into a proper location in the RAM, the location having been determined by information from line **13** in the prior field. The RAM in the converter will illustratively contain 20 bits arranged in four groups which may be called row A, row B, row C, and row D. Illustratively, the five bit authorization code will be loaded into one of the rows of the RAM. Line number **13** of the vertical interval is used to transmit a "program tag," a "market code," and further information to the converters in the field. The market code is used to prevent a converter from being taken from one cable market to another market. The transmitted program tag is used to identify a particular channel or program and is compared in the addressed converter with the stored authorization bits to establish whether that converter is authorized to descramble the corresponding program material. Illustratively, this is done by performing a logical AND operation between the 5 bit program tag transmitted on line **13** of the channel which has been selected by the subscriber with the content of a selected row of the RAM. The result of this logical operation will indicate to the converter whether the selected channel or program on the channel has been authorized to be descrambled by the converter. It will be appreciated that each of the channels transmitted by the cable operator has its own respective program tag. This particular system has exceptional versatility in that the contents of the RAM at any subscriber's converter can be changed instantly via the system controller through the transmission of the appropriate address code during the vertical blanking interval followed by updated information for storage in the RAM. Moreover, there can be tiers of authorization wherein various programs on a given channel will be authorized for some subscribers but not for others, depending on the service to which they have subscribed. For further information about one such addressable system, refer to Ensinger and Hendrickson U.S. Pat. No. 4,460,992, whose disclosure is hereby incorporated, which patent is owned by Zenith Electronics Corp.

To date, the market penetration of cable systems has been on the order of only 50 percent. Some television owners prefer not to pay the monthly charges for cable service to receive one or more of the packages or services provided by the cable operator. These non-subscribers, however, may be willing to pay the cable operator for only an occasional program. Such type of service is called "pay per view." In order to achieve this and to provide control over billing, the cable operator must have information regarding what programs are desired by various subscribers. In an addressable CATV system of the type described above, for example, a particular subscriber's converter may be updated so that it will descramble a given program—once it is determined that the subscriber is wlling to pay for that program. This can be done by having the subscriber telephone the cable operator in advance of the program to be purchased, mail a postcard, or communicate by some other means.

The problem with this type of service, however, is that it precludes impulse purchases and simultaneous response from the time the pay-per-view subscriber determines he wishes to purchase a particular program and the time it is actually viewed by him. It would be considerably more advantageous to permit a subscriber to obtain immediate results by, for example, pushing a button. This would alert the cable operator to a request for service. The system controller at the headend station immediately would change the contents of the

RAM at that subscriber's converter to permit the selected program to be descrambled. This is called "impulse pay per view" (IPPV) service.

The problem facing the industry is how to provide a system permitting IPPV service. In 1975, the Federal Communications Commission mandated that all cable systems being installed would be required to have two-way communications capability. This would permit interaction between the subscriber and the headend station. To date, about 20 percent of installed systems are capable of two-way communications, and of these only about one-half have active two-way communication. With two-way communication, the subscriber can use his home terminal or other unit to communicate with the headend station and achieve IPPV. The problem, however, resides in providing a mechanism for other subscribers served by one-way cable systems, which constitute the vast majority to have IPPV service.

For cable subscribers without two-way cable systems, a hybrid system is required for impulse pay per view service. This involves a telephone request by a subscriber for a PPV cable event followed by delivery from the cable operator headend station to the individual subscriber of a new authorization level permitting the PPV cable event to be descrambled.

The problem with hybrid systems using the telephone is substantial. The telephone system in a given city or community includes one or more central offices, each communicating with up to about 50,000 telephone subscribers. Each of the several central offices communicates with the others by trank cables. The headend station of the cable operator will be located within a region serviced by one central office. When cable subscribers telephone for pay per view service, their telephone central offices will route all of the telephone calls to the one central office servicing the headend station. Too many telephone requests at the same time to the cable operator can cause the telephone central office to "crash" due to excessive requests for physical telephone connections between numerous telephone subscribers and a single cable operator headend station. This problem is common to all hybrid systems, whether a manual telephone system or an automatic dialing system is used.

Further problems attend manual call-in systems and auto-dialing systems. The manual call-in systems are labor intensive, require long processing and holding time, have limited capacity, are not impulse in nature, and have lower penetration. They also involve possible human error. Auto-dialing systems have an advantage over manual systems, except that there is the additional expense of in-home installation of the automatic dialer.

To avoid overloading on the telephone system, one solution to providing IPPV service for one-way addressable cable systems would be to refrain from making physical telephone connections between the cable subscribers and the headend station through the various central offices. To achieve this, a new system based on automatic number identification passing referred to as "ANI passing" has been developed. ANI passing is an upgrade achieved by adding software to some central offices or by adding hardware to others, depending on their existing capabilities. In ANI passing, the central office of the telephone company will collect information based on each subscriber telephone call and pass it on to other equipment.

Thus, when a cable subscriber intends to make an IPPV request and picks up his telephone (takes it "off-hook"), a dial tone is issued to the subscriber's premises by the telephone company, and the telephone number is automatically identified, as customary within the telephone company. Now the cable subscriber can enter information using the telephone. Typically, to place a phone call, seven digits (or ten, if an area code is needed) are entered. To use ANI passing, however, some prescribed sequence of digits is used. This can take vertically any form. For example, the subscriber may enter "*85" or any other prescribed NNX number (exchange number) and then some number of digits, such as four further digits. In general, however, the total number of digits need not be seven, so long as some prescribed subscriber-entered information alerts the telephone company central office *not* to make a physical connection between the telephone subscriber and whatever location is identified by the code which follows the reserved block of codes which follows the NNX (or *85 signal). After dialing the NNX number, for example, the cable subscriber will provide further information on the telephone by sending illustratively four digits. Hence the telephone transmission to the central office may take the following form: NNX-YVVZ. In this illustrative example, the code represented by NNX activates the ANI passing system at the central office. The remaining four digits YVVZ identify what the subscriber wants to do. Illustratively, the Y digit is used to identify the cable company. In any given metropolitan area, there will be fewer than ten different cable operators, so the one digit (Y) will be able to identify the cable operator uniquely. Illustratively, the next two digits represented by VV identify the event or cable television program which the cable subscriber wishes to purchase. Next, the Z digit may represent a password which is useful for security purposes. For example, within a given household where a cable television system has been installed, parents may, through the use of a password, prevent access by children to certain types of pay per view programming. Alternatively, the Z digit can be used for other purposes. In using *85, five digits can be entered by the cable subscriber to his telephone, for a total of, for example, seven digits preceded by one special character. One of the digits may identify the cable company, two of the digits may identify the cable event to be purchased (or canceled), and two digits may be used as a password. It will be understood that these are purely illustrative, and that wide variation can occur.

As mentioned, the NNX or *85 message tells the telephone central office that it need not make a physical connection. This avoids overburdening the telephone plant. In response to receiving such an ANI transmission, the receiving telephone central office will collect and store data. Then, it will communicate by the system of the present invention with the cable headend station which has been ∓telephoned" and provide it with various information, including the telephone number of the cable subscribers who called, the user entered data, and various other information. In an area served by plural cable companies, the equipment at the telephone company central offices will send data, using the present invention, to the plural cable companies.

The object of the present invention is to provide a system which will receive information from the telephone company central offices and implement the impulse pay per view requests by cable subscribers in a satisfactory manner.

A related object of the invention is to provide a system having the ability to receive data from the telephone companies as fast as the information can be provided using the ANI passing systems.

Another object of the present invention is to permit the authorizations of the subscribers to be checked in real time.

A further object is to translate the telephone number of the cable subscriber (provided by the telephone company) into a cable subscriber code at a fast rate.

BRIEF DESCRIPTION OF THE DRAWINGS

In describing the various aspects of the present invention, reference will be made to the accompanying drawings wherein:

FIG. 1 is a block diagram of a system according to the present invention showing plural central offices and a headend station;

FIG. 2 is a block diagram of one of the several telephone communication units (TCUs);

FIG. 3 is a flow chart of the TCU software;

FIGS. 4A and 4B are diagrams of the telephone communication controller (TCC) located at the cable headend station, and FIG. 4C is a flow chart of part of the TCC operations pertaining to adaptive window multiplexing;

FIG. 5 is a flow chart of the TCC software;

FIGS. 6A, 6B and 6C are diagrams of the multiplexer circuitry;

FIG. 7 describes the inputting of data to the multiplexer from the TCC;

FIG. 8 describes the outputting of data from the multiplexer to the system controller;

FIG. 9 shows the message format of the data sent from the multiplexer to the system controller;

FIG. 10 shows the phase inverted synchronous input/output buffer system used in the system controller;

FIG. 11 is a sketch illustrating processing by the system controller, CATV encoder, and billing computer;

FIG. 12 is a sketch showing the two level searching used in the mapping algorithm applied in the system controller; and

FIG. 13 illustrates further how the four words sent to the system controller are processed.

DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. 1 shows a block diagram of a system according to the present invention. The preferred embodiment of the invention is the Zenith PHONEVISION system. As shown, the system comprises a plurality of telephone communication units (TCUs) 20 each located at a corresponding telephone company central office 22. Several central offices 22 are shown in FIG. 1 to indicate the several central offices of any metropolitan area. In the preferred embodiment of the present invention there may be as many as sixteen central offices. Also located at the telephone company central office is an automatic number identification (ANI) computer 24. The ANI computer is provided by the phone company and is activated upon receipt of a telephone call from a customer utilizing a special ANI telephone code. The ANI computer then provides specific information to its TCU on a cable 26.

Coupled to each telephone communication unit 20 is a corresponding modem 30. Modems 30 are coupled via leased telephone lines 32 or other communication channels to corresponding modems 34 located at a cable headend station 36. Each modem 34 is coupled by a cable 38 to a respective telephone communication controller (TCC) 40. The TCCs 40 are in turn coupled to a multiplexer 42 by a bus 44. Multiplexer 42 selects which one of the TCCs corresponding to the various telephone company central offices will supply data to a system controller 46. The system controller in turn is coupled to a cable TV encoder 48 as well as a billing computer 50.

In order to utilize the impulse pay per view system of the preferred embodiment described herein, a cable television subscriber would tune his addressable cable television decoder to the desired channel. The cable subscriber would then use his telephone to enter the ANI telephone code and then four or more digits. Two of the digits entered by the cable subscriber signify the particular IPPV cable event the subscriber wishes to view. Two of the other digits for illustrative purposes constitute a password number or could be used to identify which of a plurality of encoder units the subscriber wishes to enable for the desired cable event.

The telephone company central office 22 serving the cable subscriber's telephone area will be alerted by the ANI code so that when it receives the call, it will transform the "dialed" phone number (called the "destination telephone number") and other data into the so-called bulk calling line identification (BCLID) format by using the ANI computer. It will be understood that other protocols can be used by the telephone company, and that the present invention is not limited to the specific protocol adopted. In any event, the telephone company central office will not connect the incoming call from the cable subscriber to its local switch. Thus, the telephone company central offices will not become overburdened with the incoming calls from numerous cable subscribers who may all be calling on impulse to purchase a particular cable event.

The ANI computer at the telephone company central office will send the BCLID data (using seven bit ASCII code) to the TCU 20 located at the central office. The data is sent serially at 1200 baud in RS-232 format. The BCLID message contains ASCII characters representing the seven digit "destination telephone number," the ten digit origination telephone number, as well as considerable other data such as carriage return and line feed, a BCLID input/output message identifier, numerous ASCII spaces, the time of day in hours, minutes and seconds, the terminating line status and the calling line status indicator. The data sent in the telephone company's BCLID format is shown in Table I.

The "destination telephone number" carries the information entered by the cable subscriber. This will include the cable event which is to be purchased and the password. Ordinarily, this will comprise the last four of the seven digits entered by the subscriber, although any number of digits could be entered, and of these, any number could be dedicated to identifying the program to be purchased, a password, an identifier of which particular converter box at the subscriber's premises is to be used, and any other information deemed necessary or desirable by the cable company.

TABLE I

Format of BCLID Message Sent By ANI Computer 24 to TCU 20

<cr-lf>BCsaabbccssddddddsooooooooosfsgs<cr-lf>	
<cr-lf>	All messages start and stop with carriage

TABLE I-continued

Format of BCLID Message Sent By ANI Computer 24 to TCU 20	
	return line feed
BC	BCLID I/O message identifier
s	ASCII "space"
aa	Hours (24 hour format)
bb	Minutes
cc	Seconds
ddddddd	7-digit "destination telephone number"
oooooooooo	10-digit origination telephone number
f	Terminating line busy, idle status, ("0" = idle, "1" = busy)
g	Calling line DN multi-status indicator

This data is sent by the ANI computer **24** to its corresponding TCU **20** asynchronously without handshaking, and can be a continual data stream.

The TCU **20** must be able to receive and transmit the data as fast as the ANI computer **24** can send it. To promote speed, each TCU **20** strips away unneeded data and temporarily stores the remaining data in a buffer. The stored data is then transmitted synchronously to the cable headend station using a telephone line **32**. Preferably, a contracted synchronous data link control (SDLC) protocol is used for transmitting the data from each TCU **20** to its corresponding TCC **40** at the cable headend station. After the data has been transmitted to the headed station, the TCU **20** waits for an acknowledgement message from the headend TCC **40** before transmitting the next data packet. If no acknowledgement or a negative acknowledgement message is received, TCU **20** retransmits the previously transmitted data packet. The TCU **20** provides for error free transmission to TCC **40** with no data loss. Since much of the unnecessary information of Table I is removed, as will be described, by the TCU **20**, and due to the buffering occurring at each TCU **20**, each TCU **20** is able to operate at a rate fast enough to keep up with ANI computer **24**. Each TCU **20** also provides for conversion of the BCLID data received from the phone company to the modified SDLC protocol format.

A block diagram of a TCU **20** located at one of the telephone central offices is shown in FIG. **2**. It includes an Intel 8085 central processing unit ("CPU") **52**, a 4K×8 static RAM **53**, a 16K×8 EPROM **54**, a 4K×8 EPROM **55**, two Intel 8250 Asynchronous Communication Elements **56**, **57**, an Intel 8273 programmable HDLC/SDLC protocol controller **58**, chip select logic **59** and watchdog reset circuitry **60**. A sixteen bit address and eight bit data bus **61** provide communication among the various components of TCU **20**. The serial data from the telephone office ANI computer **24** is applied to a serial data input pin of communication element **57** by a line **62** which is coupled to cable **26** through a line receiver (not shown). The equipment on this board, according to the preferred embodiment, has two asynchronous channels and one synchronous channel.

The CPU **52** in the preferred embodiment illustratively operates at four megahertz. Its instruction code is stored in EPROM **54**. The EPROM **55** may contain look-up tables. RAM **53** is used to buffer data packets, for stack purposes and for program use. Chip select logic **59** is used to determine whether the read or write operation is required of the memory mapped devices and to determine the exact device being addressed.

As mentioned, once the data from the telephone office ANI computer **24** is received, TCU **20** strips away unwanted data. The data that is kept is the seven digit (illustratively) "destination telephone number" entered by the cable subscriber (which includes the data the cable event to be purchased), the ten digit phone number of the cable subscriber, the terminating line status and the calling line indicator. These nineteen characters are ASCII characters, and are temporarily stored or buffered in RAM **53** to await transmission to the corresponding TCC **40** at cable headend station **36**.

FIG. **3** contains a flow chart of the software which controls the inputting of data from the telephone office ANI computer **24** and the outputting of data to the cable headend TCC **40**. A listing of the TCU software is contained in Appendix I. Referring to FIG. **3**, after data is received from ANI computer **24** at block **64**, unwanted data is stripped, temporarily stored, and then sent in packets to the headend unit as shown at blocks **65**, **66** and **67**. Then TCU **20** determines at decision diamonds **68** and **69** whether a positive acknowledgment has been received from the headend. If not, retransmission of the data packet occurs, as indicated by route **70**. If there is stored data in RAM **53**, determined at diamond **71**, further data packets are sent to the headend, as indicated by route **72**. Otherwise, data continues to be received, as always, and put into a buffer (RAM) until processed.

The nineteen ASCII characters sent by TCU **20** to its TCC **40** are sent via a line using a contracted SDLC protocol which is reflected in Appendix I. Briefly, however, the SDLC protocol is modified to preserve the package format, zero bit insertions, and the frame check sequence ("FCS code"), with all else eliminated. The data is sent synchronously, serially, at 1200 baud, and is RS-232 compatible. Handshaking is used, so that for every packet sent from the TCU **20**, a positive acknowledgment is required in the preferred embodiment before the next packet is transmitted. Table II shows the illustrative message format of the data sent from a TCU **20** to its TCC **40**. Table III shows the illustrative acknowledgment message sent from a TCC **40** to its corresponding TCU **20**.

TABLE II

Message Sent From The TCU To The TCC
[address] [packet ID]NNXDDDDAAACCCCLLLYZ[FCS] [FCS]
[ ] denotes an 8-bit quantity address = FF hex NNX = ANI identifier, e.g., *85 or 1st 3 digits of destination phone no. D = User data A = Area Code C = First 4-digits of subscriber's phone number L = Last 3-digits of subscriber's phone number Y = Terminating line status (line busy or not) Z = Calling line indicator (public line or private branch exchange) [FCS] = Frame check sequence for error checking

TABLE III

Acknowledgment Message Sent From The TCC 40 To The TCU 20
[address] [packet ID] [acknowledgment byte] [FCS] FCS]
acknowledgment byte = C3 hex for NACK = A5 hex for ACK
[ ] denotes an 8-bit quantity

It will be understood that these processes occur at each of the several central offices of the telephone company serving the cable companies areas. The system as described so far collects data in real time. The collected data are the requests of subscribers, and this is achieved using a system compatible with ANI passing. Data is sent from multiple telephone central offices to a cable headend station. The data provided includes the subscriber's telephone number and his request, which is couched in the destination telephone number.

Turning now to the cable headend station **36**, the basic functions of each TCC **40** in the preferred embodiment are to receive data packets from the several telephone central offices **22**, store the data temporarily, perform some conversions into binary and BCD, reformat the data, and communicate it quickly to system controller **46** via temporary storage in multiplexer **42**. As seen in FIG. **1**, there are several TCC units **40** corresponding to the several telephone central offices **22**.

A block diagram of an illustrative TCC **40** located at the cable headend station **36** is shown in FIG. **4A**. The same components are used in the TCC **40** as in the TCU **20**, and in the same configuration. As with TCU **20**, this board has asynchronous and synchronous capability. In TCC **40**, the synchronous ports of the Intel 8250 chips are used. Each TCC **40** additionally includes a board select and I/O bus control logic circuit **74** shown more particularly in FIG. **4B**. This circuitry illustratively comprises two Intel 8255 programmable peripheral interface (PPI) chips represented by **75**, an eight bit transceiver **76**, a four bit magnitude comparator **77** and a four pole DIP switch **78**. Switch **78** is used to set the select address of the particular TCC. For example, the first TCC would have all four poles of the switch arranged so that each outputs a logic "0." The switch outputs are connected to one side of the magnitude comparator, and the other side of the comparator is coupled to four board select lines **79** coupled to multiplexer **42**. When comparator **77** sees a match in its two inputted values, it generates a match signal that is inputted via a serial input data (SID) line **80** to the CPU of FIG. **4A** alerting it that the TCC board is being offered the opportunity by multiplexer **42** to output data.

The I/O control logic part of circuit **74** handles the outputting of eight bit parallel data sent to multiplexer **42**. In order to transfer data from TCC **40** to multiplexer **42**, a check is made to ensure that multiplexer **42** is ready to receive a data byte. Then transceiver **76** (FIG. **4B**) is enabled by the one of PPI chips **75**. The data to be transferred is then written into the same PPI chip. If multiplexer **42** is ready, the data byte is strobed into the multiplexer by performing a write operation. Four bus control lines **81**, **82**, **83** and **84** (CLEAR/RESET, STOP, FULL, WRITE) are used to check if the multiplexer is ready for data and to strobe the data into the multiplexer.

This process can be referred to as part of what is referred to herein as "adaptive window multiplexing" wherein multiplexer **42** addresses in sequence each of several TCCs **40**, any of which may or may not have data to output. However, the time allotted to any one TCC is not fixed, as in conventional multiplexing. For the most part, the time taken by any single TCC **40** depends on how much data, if any, needs to be sent from that TCC **40** to multiplexer **42**, subject to limitations of the memory used for buffering in the multiplexer, as described infra. Referring to FIG. **4C**, multiplexer **42** provides address outputs in sequence. The CPU on each TCC **40** looks for its own address (i.e. the address of its board) being issued by the multiplexer, as indicated by diamond **85**. The CPU will know whether it has any data (stored temporarily in RAM) to send. If there is such data, then when the CPU sees its address issue, it will stop multiplexer **42** from progressing to the address of the next TCC in sequence by bringing the STOP line **82** low, indicated by block **86**. A short time later (interposed for example by the execution of a few instructions), the CPU ON TCC **40** checks to make sure that the address at which multiplexer **42** did stop is indeed the address of this particular TCC **40** (diamond **87**). If so, then the CPU will cause a fast data transfer (at a rate of 56K bytes/sec) to the multiplexer (block **88**, **89**, **90**). If the address is wrong, then the CPU will release STOP line **82**, and thereby multiplexer **42**, and not send data (block **91**). This is a double check to ensure that only one TCC **40** sends data to the multiplexer **42** connected to bus **44**. In FIG. **4B**, bus **44** comprises lines **79** and **81** to **84**.

As stated, each TCC **40** has circuitry **74** not included in any of the TCUs **20**. While each TCC **40** uses different software than the TCUs, both the TCU and the TCC program is stored in the 16K×8 EPROM, and the 4K×8 RAM is used to buffer data, for stack purposes and for program use. The RAM has a portion which is used as an input buffer and another portion used as an output buffer. A flow chart of the software used in the TCC of FIG. **4A** is shown in FIG. **5**. A listing of the TCC software is contained in Appendix II.

An important function of each TCC **40** in the preferred embodiment is to convert the ASCII data received from its corresponding TCU **20** into a format more readily usable by the system controller **46**, which preferably is a Hewlett-Packard HP-1000 computer. The conversion occurs at block **94** of FIG. **5**. The last three digits of the originating phone number (LLL in Table II) are converted into a ten bit binary number. The first four originating digits (CCCC in Table II) are converted into a fourteen bit binary number. The area code of the originating phone number is converted into a two bit binary number (it being assumed that no more than four area code regions are covered by the several telephone central offices which serve the subscribers of the cable operator). The numbers entered by the cable subscriber (DDDD in Table II) representing the cable event and the password are converted into binary coded decimal (BCD) values.

The following example illustrates the novel conversion of a three digit ASCII number to a ten bit binary number. In this example "h" following a number indicates that hexadecimal base is used and "d" indicates that the number is a decimal number. The number to be converted is 0110100 (34h) 0110011 (33h) 0110010 (32h), i.e. 432d. The least significant ASCII digit (i.e., the decimal "2" in the "ones" decimal column) is converted into its binary equivalent by subtracting 30h from the digit: 32−30=02h. The second ASCII digit (the next most significant digit, i.e. the "3" in the "tens" column) is then converted to binary with tens-place weighting. This is converted to binary as in the previous conversion, i.e. 33h−30h=03h. Then the base address of a look-up table stored in an EPROM in TCC **40** for the tens units is added to this value in order to find an address in the look-up table. Then, using this address, a value is obtained from the look-up table. For the number 03h in the tens place, the value read from the look-up table is 1Eh (30d). This is a weighted conversion

process. The same weighted conversion process is used for the third ASCII digit, but with different weighting. For 04h (34h−30h) in the hundreds place, the look-up table value is 190h (400d). The hexadecimal values are then combined: 190h+1Eh+02h=1BOh (432d). The conversion process for a four digit ASCII number is similar to the process explained above except, of course, thousands-place weighting is also used.

The following is an example of a conversion of a three digit ASCII value area code to a two bit binary number. In this example "b" following a number indicates that the number is in binary, and again "h" indicates hexadecimal. The area code to be converted is 33 31 32, i.e. 312d. The first ASCII digit is converted into a hexadecimal value by subtracting 30h (32h−30h=02h=000000010b). The second digit is converted in the same manner (31h−30h=01h=00000001b) and this value is rotated left four places (0000001b→00010000b). The first and second values are then combined, and stored in a register of the CPU of the TCC 40 (000000010b+00010000b=00010010b=12h). The third ASCII digit is converted into a hexadecimal value to which the look-up table base address (F0h) is added (33h=30h=03h; 03h+F0h=F3h). The sum value is stored in a CPU register. The first and second register pair (F312h) contains the address where the desired two bit value is found corresponding to the 312 area code.

After the ASCII numbers are converted into the appropriate form, they are stored (block 95 of FIG. 5) in the output buffer portion of the on-board RAM of TCC 40 until multiplexer 42 indicates that it is ready to receive data (indicated at 96). In addition, the data to be sent to the multiplexer is arranged in a particular format by the TCC 40 before it is transferred. This is done so that when the data is eventually sent to system controller 46, it will be able to process the data without excessive manipulation. The format of the data sent to multiplexer 42 is shown in Table IV. As can be seen, the data is transferred (block 97) in eight bytes, each byte having eight bits. Note that byte 1 contains the two bit binary area code data as well as the first six binary bits of the converted last four digits of the originating phone number. Note also that zeros are inserted into a portion of byte 3 and in all eight bits of bytes 5 and 7.

TABLE IV

	Data Sent To The Multiplexer From the TCC
BYTE 1:	[(2-bit area code) (1st 6-bits of CCCC)]
BYTE 2:	[remaining 8-bits of CCCC]
BYTE 3:	[000000 (1st 2-bits of LLL)]
BYTE 4:	[remaining 8-bits of LLL]
BYTE 5:	[00000000]
BYTE 6:	[8-bit event #]
BYTE 7:	[00000000]
BYTE 8:	[8-bit user pass word]

C = One of the first 4 digits of subscriber's telephone number (now binary)
L = One of the last 3 digits of subscriber's telephone number (now binary)

Several steps are taken in each TCC 40 to ensure the reliability of data. The system overwrites (block 98) any data which is retransmitted (which can occur when a negative acknowledgment issues) (decided at diamond 99). This avoids excessive data. Note also that in this flow chart, if TCC 40 determines that data is to be received from its TCU 20 (diamond 100) then the TCC will postpone a data transfer, even if data is in the output buffer (decided at diamond 101). Thus, inputting has priority over outputting, to ensure against losing data. The rationale is that inputted data and data ready for outputting can both be buffered. The data transfer rate on outputting is so high (illustratively 56K bytes/sec) that some delays can be tolerated to allow for inputting.

A block diagram of the preferred embodiment of multiplexer 42 is shown in FIG. 6A. The multiplexer performs three major functions, namely: (1) selecting one of the sixteen possible TCCs to receive data from at any given time, (2) buffering the received data until system controller 46 is ready to receive it, and (3) transferring the buffered data to the system controller.

Multiplexer 42 illustratively comprises two Mostek 4501 first-in, first-out (FIFO) dual port memory chips 102, 103, bus interface control and buffer load logic 104, oscillator and select logic 106, reset circuitry 108, input-/output control logic 110 and two output buffers 112 and 114. Data is received from TCC 40 on an eight bit data bus 116 and transmitted to the system controller 46 on a sixteen bit data bus 118.

The oscillator and select logic 106, illustrated further in FIG. 6B, selects which one of the TCC units 40 data is to be received from. This oscillator circuitry may comprise a schmitt-trigger inverter with its output looped back to is input through a low-pass filter to form an 8 KHz oscillator 120 (FIG. 6B). This clock signal is used to perform dummy read operations during a system controller request for reset and to increment a board select counter. The board select counter of circuit 106 is illustratively a four bit binary counter 121 with its Enable control coupled to a single stop line 82 which in turn is coupled to all sixteen of the TCC units 40. Counter 121 continually cycles from 0 to 15 until halted by any of the TCC 40 requesting a data transfer by taking stop line 82 low. Once the data transfer is completed (i.e., the output buffer portion of the RAM in the TCC of the addressed TCC has been emptied), stop line 82 is returned high by such TCC 40, and counter 121 is allowed to resume its counting in order to address the next TCC in sequence. As shown in FIG. 5, if there is no data in the output buffer of the addressed TCC (decision diamond 101), then such TCC will not seize the opportunity to write data onto the eight bit bus 116 (FIG. 6) coupled to multiplexer 42. Instead, such TCC 40 will continue receiving and processing synchronously sent packets of data from its TCU 20 and will permit multiplexer 42 to address the next TCC 40 in sequence. Thus, the length of time or the window during which data is received by the multiplexer from a particular TCC adapts according to the amount of data in the TCC output buffer available at the time for transfer, as part of the adaptive window multiplexing technique.

Bus interface control and buffer load logic 104 is responsible for strobing data from a TCC 40 into the correct FIFO buffer 102 or 103. This circuitry is illustrated in FIG. 6C and inserts all of the odd number bytes, i.e. bytes 1, 3, 5 and 7 received from a TCC 40 into FIFO 102 and all of the even number bytes, i.e. bytes 2, 4, 6 and 8 into FIFO 103.

A flow diagran for multiplexer 42 describing the input of the data from the TCCs is shown in FIG. 7. As counter 121 increments, its output is sent on a four line bus (A0, A1, A2, A3 of FIG. 6B), as indicated at block 130 of FIG. 7. Multiplexer 42 then determines whether STOP line 82 has been brought low, at decision diamond 131, for a requested data transfer. If so, counter 121 is stopped (block 132; see also the logic circuit 133 coupled to the Enable input of counter 121 in

FIG. 6B). Data is then written into FIFOs 102, 103 (block 134 in FIG. 7), and counting is resumed (block 135).

The outputting of data from multiplexer 42 is shown in the flow diagram of FIG. 8. This includes determining whether multiplexer 42 has any temporarily stored data ready for outputting (diamond 136). Also a determination is made as to whether system controller 46 is ready for a transfer (diamond 137).

It should be noted that the inputting of data to multiplexer 42 is completely independent of the outputting of data from the multiplexer to system controller 46. This allows the telephone central office computers 24 and associated TCUs 20 to operate harmoniously with the system controller 46 at the headend station.

Referring again to FIG. 6A, the input/output control logic 110 performs the handshaking between the multiplexer and the system controller. The handshaking process uses four control lines and corresponding signals: an end of message (EOM) signal on a line 139, a device command (DVCMD) on a line 140, a device flag (DVFLG) on a line 141, and a reset signal on a line 142. Data is transferred from multiplexer 42 to system controller 46 on bus 118 in response to the DVCMD signal, meaning that system controller 46 is ready to receive data, and a FIFO empty (FE) line 143 from FIFO 102 indicating that data is available for transfer, i.e., the FIFO is not empty. At that time, a read line 144 to the FIFO is activated as is the DVFLG line 141 to system controller 46. Once three complete words have been transferred to system controller 46, the EOM control line 139 goes high, signalling that the next word to be transferred will be the last word (Word #3).

System controller 46 preferably is an HP-1000 computer, which reads four words at a time. To ensure against loss of data, the reset signal on line 142 (from system controller 46) forces multiplexer 42 to perform dummy reads from FIFO buffers 102, 103 in order to ensure completion of a four packet transfer. The dummy reads are performed until the EOM signal on line 139 is detected at which time the reset circuitry 108 is disabled and normal read operations are resumed.

Multiplexer 42 converts the eight 8-bit bytes received from each TCC 40 into four 2-byte words which are sent to the system controller at a rate of up to 2M bytes/sec. The conversion process is accomplished by combining the data words stored in the odd byte FIFO 102 with the data words stored in the even byte FIFO 103 to produce a single 2 byte (sixteen bit) word. The sixteen bit words are sent to system controller 46 on the bus 118.

FIG. 9 shows the format of the data words sent by multiplexer 42 to controller 46. The first two bits 144 of Word 0 represent the telephone area code of the cable subscriber originating the IPPV call. The area code was converted into the two bit format by a TCC 40. The number CCCC represents the first four digits (excluding the area code) of the cable subscriber's phone number, converted to binary by the TCC. The three Xs shown in Word 0 and the four Xs of Word 1 are used only to indicate the place of the numbers. The number LLL in Word 1 represents the last three digits of the cable subscriber's phone number, but in binary form. The event 145 and password 146 in Words 2 and 3, respectively, are the numbers entered by the cable subscriber to select a particular cable event. These numbers were converted to BCD (binary coded decimal) by the TCC 40 which processed the data.

By comparing the data format in FIG. 9 with Table IV, it can be seen that Word 0 sent from the multiplexer 42 to the system controller 46 is made up of bytes 1 and 2 sent to the multiplexer from TCC 40. Likewise, Word 1 is made from bytes 3 and 4, Word 2 is made from bytes 5 and 6, and Word 3 is made from bytes 7 and 8. The data sent to system controller 46 is sent in the format shown in FIG. 9 so that the system controller can process the information without extra manipulation. This speeds up the rate at which a cable subscriber's one-way addressable converter is authorized after the subscriber places an IPPV call.

System controller 46 processes the four sixteen bit words of FIG. 9 to identify the cable subscriber, find the subscriber's decoder address, and change the decoder authorization to allow viewing of the program selected by the subscriber (or to implement a cancellation at the subscriber's request). The system controller also initiates proper billing of the transaction by sending information to billing computer 50.

The four words sent to the system controller are sent directly to the buffer memory of the controller using direct memory access (DMA). In order to process the data sent to it at the fastest possible rate, system controller 46 employs a phase inverted synchronous input/output process using four buffers, two for input and two for output. FIG. 10 show a diagram of this buffer system. While an input buffer 147 is receiving data from multiplexer 42, an output buffer 148 is outputting data to the cable TV encoder 48 or the billing computer 50. Concurrently, data from an input buffer 149 is being processed and sent to an output buffer 150. These concurrent processes are represented by the solid and broken lines in FIG. 10. When the data in input buffer 149 is exhausted, output buffer 150 receives data from other sources until it becomes filled. During this time, output buffer 148 continues to output data. When buffer 148 no longer has data to output, system controller 46 is interrupted, and the buffer arrangement is inverted. The inputting, outputting and processing after the interrupt is shown by the broken lines in FIG. 10. After the interrupt, data is inputted into input buffer 149; output buffer 150 sends data to cable TV encoder 48 or billing computer 50; and data from input buffer 147 is processed and sent to output buffer 148. This alternating process is continually repeated to ensure that processor 46 does not waste time waiting for data to be inputted or outputted.

As mentioned, system controller 46 processes the four words sent to it by multiplexer 42 to locate ("map") the address of the one-way addressable converter for the cable subscriber initiating the IPPV call, to check the password entered by the cable subscriber and to change the authorization code in the cable subscriber's converter in order to allow him to view the cable event. FIG. 11 is a diagram which should be helpful to understand the processing which occurs at system controller 46, addressable CATV encoder 48 and billing computer 50. Data from multiplexer 42 is applied to one of the input buffers of FIG. 10 which is represented as a buffer 151 in FIG. 11 receiving an input via line 152. The inputs comprise the four words depicted in FIG. 9. These four words are used to determine the action which is to occur. Words 0, 1 and 3 are used to map the telephone number of the subscriber into the address code of his converter, as shown at 154. Referring back to FIG. 9, it will be seen that Word 0 comprises the area code and part of the telephone number of the sub-

scriber, and Word 1 completes the telephone number of the subscriber. At 154, system controller 46 finishes mapping the telephone number to the unique address code of the converter of the cable subscriber. Word 3 is used to make sure that the password is valid or, alternatively, to determine which of several converters are to be authorized at the premises of the cable subscriber. In this mapping function, system controller 46 refers to a data base 156, discussed infra. In the event that system controller 46 cannot map the telephone number into a converter code (because, for example, of a wrongfully dialed telephone number), an error is generated at 158. That error can also be generated if the data base reflects the unavailability of the event for purchase by that particular subscriber, because of bad credit, tardy bill payments, or whatever reasons are considered to be adequate by the cable company.

Word 2 of FIG. 9 identifies the cable event which the cable subscriber wishes to purchase or to cancel. Word 2 is applied at 160 to determine the action which is requested by the subscriber. The system provides for the subscriber to either request a pay per view cable event or, if he wishes, to cancel it within a prescribed time. Referring to a schedule 162, the determination is made as to whether the cable event is requested to be turned on or off. If no such cable event is found in the schedule 162, an error 164 will be generated. Assuming that there are no errors in the determinations 154 or 160, then an authorization to program the cable subscriber's converter as well as a program tag and a program identification are provided to an output 166. From there, the information is provided to an output buffer 168 which holds information until the CATV encoder 48 processes it.

In addition, from the output 166 information including the converter indentification, the program identification, and a timestamp are posted to a disk at 170 within system controller 46. Subsequently, these postings are unloaded to billing computer 50, typically on the next business day. Billing computer 50 had editing capabilities via a line 172 with data base 156. Thus, if desired by the cable company, the billing computer can edit the data base so that no cable subscriber can exceed some limitation per month on cable pay per view events. Also, the system can provide in this manner for preventing any pay per view events from being purchased by a cable subscriber while permitting normal cable operation. This will be determined by the policy of the cable company, but the present system provides the flexibility to achieve all objectives of the cable company. FIG. 12 further illustrates the mapping process occurring in system controller 46. To map the telephone number of the subscriber into an authorization code, system controller 46 preferably uses a two level tree having a root and many leaves. In the preferred system, a root corresponds to one page of memory (which is 1024 words, each 16 bits) and each leaf also is one page of memory. The root uses table searching. Thus, in FIG. 12, Word 0 is used to search the root at 180. The root usually has between 10 and 50 entries, which corresponds to the fact that the first four digits of a seven digit telephone number used by the telephone company occur in selected groups. In other words, there is a limitation used by the telephone company so that although four digits are used, there are fewer than 10,000 numbers which are actually assigned, although 10,000 are theoretically possible. This root is sometimes referred to as the PHIN root, standing for "phone index." In the event that the searching at 180 does not locate the number which has been specififed by Word 0, than an error is indicated as shown at 182. However, if the root is found at 180, then Word 1 is used to search the leaf at 184. The leaf has many parts, the Word 1 is used to arrive at a correct pointer stored in the leaf. This method is referred to as direct indexing by persons skilled in the art, and is a time efficient method. The pointer will lead to the correct information for the converter of the cable subscriber who telephoned his request. In the event that the direct indexing does not locate the pointer, then an error is indicated at 186. If the pointer is found, then Word 3 is used to check the password at 188. If the password matches, then authorization can be provided at 190. If, however, the password does not match, then an error will issue at 192.

FIG. 13 illustrates the processing of the four words of FIG. 9 more particularly. Word 0 at block 200, containing the two bit area code and the fourteen bit number group corresponding to the first four digits of the cable subscriber's telephone number, is used to locate within a phone index (PHIN) root 202 one of several leaves 204. Word 1 at block 206 containing the ten bits corresponding to the last three digits of the cable subscriber's telephone number is used to find the particular slot in the phone index leaf 204 containing a pointer to the unique data of interest. This points to a block 208 which contains the home unit control block (HUCB) comprising the cable subscriber's one-way addressable converter address, the current authorization code for the cable subscriber, a password and an IPPV flag. The password is then read from the home unit control block and compared at block 210 with the password contained in Word 3 which is represented by block 212. If the two passwords match, the home unit control block authorization bits are then updated at block 214 with the event number contained in Word 2 (in block 216). The new home unit control block information is then sent out to the cable subscriber's converter so that the converter will be enabled, thus allowing the viewer to view the program selected by the IPPV call. System controller 46 also downloads the necessary information to billing computer 50 so that the cable subscriber will be billed for the IPPV event.

Thus, it will be appreciated that at the cable headend station, data from multiple telephone offices are gathered, mapped into addresses and converter authorization codes (provided no errors are found), posted for billing purposes, and encoded for nearly instant updating. The mapping for each request preferably occurs in more than one step at plural locations, so the burden on the system controller is eased. As described herein, each TCC 40 converts ASCII characters for received phone numbers into binary data, and converts the ASCII characters identifying the PPV event to be purchased as well as the password into BCD. At the system controller, these data are mapped fully into converter addresses and program tags.

By the system of the present invention, there is provided a system for accepting impulses purchases from cable subscribers who do not have two-way cable TV systems. The described system is compatible with ANI passing, and accepts information provided by the telephone office ANI computer as fast as the computer can supply it. The data is automatically translated into a form usable by the system controller and communicated at a fast rate. Appropriate error checking occurs along the entire stream of data flow to ensure reliability. The

requests of the cable subscribers are checked in real time, and barring any reason to forbear, the cable subscriber's cable TV addressable converter is authorized to allow the subscriber to view or cancel the cable event as desired. After the cable event is completed, the system controller clears the data base of the authorizations.

It will be appreciated from the foregoing discussion that the device at the subscriber premises, which has been variously described as a "converter," "converter box," or "decoder," and which has been said to be able to descramble signals, may generally be referred to as an "access terminal unit."

It will be apparent that numerous modifications can be made within the scope of the present invention. The arrangement described herein is illustrative, and the scope of protection is indicated by reference to the following claims.

```
LOC  OBJ        LINE        SOURCE STATEMENT

                ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                ;       COPYRIGHT 1985 ZENITH ELECTRONICS CORP.
                ; THIS PROGRAM WAS WRITTEN BY GORDON E. REICHARD ON 6/24/85.
                ; THIS PROGRAM IS CALLED TCU200, ALSO REFERRED TO AS Z-TCU200.
                ; THE PROGRAM PERFORMS THE FUNCTION OF RECEIVING SERIAL DATA FROM
                ; THE TELEPHONE COMPANY'S COMPUTER, STRIP AWAY UNWANTED DATA, AND
                ; TRANSMIT REMAINING DATA TO HEADEND.
                ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                        ;
                        ;
                ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                ; BEOW ARE THE EQUATE STATEMENTS USED TO ASSIGN LABELS TO
                ; HEXIDECIMAL VALUES.
                ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                        ;
                        ;
9000            ADATA   EQU     9000H           ;ASYNC  DATA PORT, 8250
9000            BAUDLS  EQU     ADATA           ;LSB OF BAUD RATE
9001            BAUDMS  EQU     ADATA+1         ;MSB OF BAUD RATE
9003            LCR     EQU     ADATA+3         ;LINE CONTROL REG. 8250
9001            DISINR  EQU     ADATA+1         ;DISABLE INTERRUPT REG. 8250
9005            ASTAT   EQU     ADATA+5         ;ASYNC STATUS PORT, 8250
4000            RAM     EQU     4000H
4000            BUFFER  EQU     RAM             ;IN AND OUT BUFFER
6000            SCMDRG  EQU     6000H           ;SYNC COMMAND REG. 8273
6000            SSTAT   EQU     SCMDRG          ;SYNC STATUS REG. 8273
6001            SPRMRG  EQU     SCMDRG+1        ;SYNC PARAMETER REG.
6001            RESULT  EQU     SPRMRG          ;RESULT REGISTER
6002            TXIR    EQU     SCMDRG+2        ;TRANSMIT INTERRUPT REG.
6003            RXIR    EQU     SCMDRG+3        ;RECEIVER INTERRUPT REG.
4FA0            POINTO  EQU     4FA0H           ;OUTPUT POINTER
4FA2            POINTI  EQU     POINTO+2        ;INPUT POINTER
7000            SDATAO  EQU     7000H           ;SYNC DATA OUTPUT, 8273
B000            SDATAI  EQU     0B000H          ;SYNC DATA INPUT, 8273
4FA4            INCOME  EQU     POINTI+2        ;INCOMING DATA PACKET PENDING
FF0C            COUNTS  EQU     0FF0CH          ;B AND C COUNTERS
4FA5            TXSTAT  EQU     POINTI+3        ;CURRENT 8273 X-MIT STATUS
4FA6            ACKFLG  EQU     POINTI+4        ;ACKNOWLEDGEMENT FLAG
4FA7            XMIT    EQU     POINTI+5        ;START ADDRESS OF X-MIT SET-UP
4FAC            CNTRL   EQU     XMIT+5          ;CONTROL FIELD FOR SDLC FRAME
4FAC            ID      EQU     CNTRL           ;PACKET ID NUMBER RAM LOCATION
4FAD            PACKET  EQU     POINTIZ+11      ;PACKETS REMAINING IN RAM
4FB0            ACKBYT  EQU     4FB0H           ;MEM. LOCATION OF TIME-OUT COUNTER
4FB1            CRTBUF  EQU     4FB1H           ;DATA HERE IS OUTPUT TO CRT
4FB2            STATUS  EQU     4FB2H           ;STATUS BYTE READ FROM 8273
4FB3            CURRENT EQU     4FB3H           ;CURRENT OUTPUT POINTER (ALSO 4FB4H)
4FB5            PTINP   EQU     4FB5H           ;RIGID INPUT POINTER, INCREMENTS OF 13H
```

```
4FB7                TIME     EQU     4FB7H        ;TIME OUT COUNTER
E000                RESET    EQU     0E000H       ;WATCH DOG RESET CIRCUIT ADDRESS
                             ;
                             ;
                    ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                    ; THIS BEGINS THE INITIALIZATION OF REGISTERS AND CHIPS.
                    ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                             ;
                             ;
0000                         ORG     0000H
0000 F3                      DI
0001 3E19                    MVI     A,19H        ;ENABLE INTERRUPTS, 7.5 AND 6.5
0003 30                      SIM                  ;SET INTERRUPT MASK
0004 210040                  LXI     H,RAM        ;SET ALL POINTERS TO TOP OF RAM
0007 22B34F                  SHLD    CURRENT
000A 22A24F                  SHLD    POINTI
000D 22A04F                  SHLD    POINTO
0010 22B54F                  SHLD    PTINP
0013 C34000                  JMP     BEGIN
                             ;
002C                         ORG     002CH        ;RST 5.5
002C C30502                  JMP     GETACK
                             ;
0034                         ORG     0034H        ;RST 6.5
0034 C38E01                  JMP     OUTDAT
                             ;
003C                         ORG     003CH        ;RST 7.5
003C C31FC1                  JMP     DATAIN
                             ;
0040                         ORG     0040H        ;BEGINNING OF MAIN PROGRAM
0040 310050         BEGIN:   LXI     SP,5000H     ;SET STACK POINTER TO TOP
0043 CDD402                  CALL    I82501       ;INITIALIZE 8250, IC1
0046 CD1703                  CALL    I82502
0049 CDFB02                  CALL    I8273
004C CD6E03                  CALL    IXMIT        ;SET-UP OUTPUT ARRAY
004F 3E0C                    MVI     A,0CH        ;HEADER COUNT
0051 32A44F                  STA     INCOME       ;STORE HEADER COUNT
0054 3E00                    MVI     A,00H
0056 32AD4F                  STA     PACKET       ;ZERO PACKET COUNT
0059 32AC4F                  STA     ID           ;RESET ID NUMBER
                             ;
                             ;
                    ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                    ; THIS MARKS THE BEGINNING OF THE MAIN BODY OF THE PROGRAM.
                    ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                             ;
                             ;
005C 3EFF           MAIN:    MVI     A,0FFH       ;SET FLAG, NO ACKNOLEDGES EXPECTED
005E 32A64F                  STA     ACKFLG
0061 2AA24F                  LHLD    POINTI       ;LOAD HL WITH INPUT POINTER
0064 CDCA00                  CALL    HLOOK        ;GET INPUT DATA PACKET ONLY
0067 CD7901                  CALL    UP13         ;INCREMENT INPUT POINTERS TO NEXT INPUT BLOCK
006A 3E0C                    MVI     A,0CH        ;SET-UP INCOME COUNTER FOR NEXT DATA INPUT
006C 32A44F                  STA     INCOME
006F 3E01                    MVI     A,01H        ;SINCE ONE PACKET HAS BEEN RECEIVED
0071 32AD4F                  STA     PACKET       ;SET PACKET COUNT EQUAL TO 1
0074 F3             TXSTRT:  DI                   ;DISABLE INTERRUPTS
```

```
0075 3E09            MVI   A,09H        ;ENABLE 7.5 AND 6.5
0077 30              SIM
0078 21A74F          LXI   H,XMIT       ;PREPARE TO TURN-ON TRANSMITTER
007B CD3903          CALL  CMDOUT       ;OUTPUT COMMANDS
007E FB      MLOOP:  EI
007F 3200E0          STA   RESET        ;HIT RESET CIRCUIT
0082 00              NOP
0083 C37E00          JMP   MLOOP        ;IF NOT, KEEP LOOPING
0086 21FFFF  ACKLOP: LXI   H,0FFFFH     ;SET-UP TIME-OUT COUNTER FOR 24MS
0089 22B74F          SHLD  TIME
008C 2AB74F  ACKLP2: LHLD  TIME         ;GET CURRENT TIME-OUT COUNT
008F 2B              DCX   H            ;DECREMENT THAT VLAUE
0090 22B74F          SHLD  TIME         ;STORE NEW VALUE
0093 7C              MOV   A,H
0094 A7              ANA   A            ;SEE IF COUNT IS EQUAL TO ZERO
0095 CAA200          JZ    NOACK        ;IF COUNT IS ZERO, NO ACK.
0098 FB              EI
0099 3200E0          STA   RESET
009C 00              NOP
009D 00              NOP
009E F3              DI
009F C38C00          JMP   ACKLP2
00A2 F3      NOACK:  DI
00A3 2AA04F          LHLD  POINTO       ;TREAT NO ACK. AS A NACK
00A6 22B34F          SHLD  CURRENT      ;RESET POINTER TO RETRANSMIT
00A9 216803          LXI   H,DR         ;PREPARE TO DISABLE RECEIVER
00AC CD3903          CALL  CMDOUT
00AF 3E09            MVI   A,09H        ;ENABLE 7.5 AND 6.5
00B1 30              SIM
00B2 FB              EI                 ;ENABLE INTERRUPTS
00B3 00              NOP
00B4 3200E0          STA   RESET        ;WAST TIME TO SEE IF DATA IS AVAILABLE
00B7 C37400          JMP   TXSTRT       ;BEGIN RETRANSMISSION
                     ;
00BA F3      INLOOP: DI
00BB 3AAD4F          LDA   PACKET       ;GET PACKET COUNT
00BE A7              ANA   A            ;IS THERE A COMPLETE PACKET IN RAM
00BF C27400          JNZ   TXSTRT       ;IF SO, BEGIN TRANSMISSION
00C2 FB              EI                 ;ELSE WAIT FOR COMPLETE PACKET
00C3 3200E0          STA   RESET        ;HIT RESET CIRCUITRY
00C6 00              NOP
00C7 C3BA00          JMP   INLOOP
                     ;
             ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
             ;
             ;LOOK FOR DATA WITHOUT HAVING ANY DATA TO OUTPUT.
             ;
             ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
00CA 3A0590  HLOOK:  LDA   ASTAT        ;GET STATUS
00CD E601            ANI   01H          ;IS DATA AVAILABLE
00CF 3200E0          STA   RESET        ;HIT RESET CIRCUITRY
00D2 CACA00          JZ    HLOOK        ;IF NOT, WAIT
00D5 3A0090          LDA   ADATA        ;ELSE, READ DATA BYTE
00D8 FE42            CPI   42H          ;IS IT AN ASCII B
00DA C2CA00          JNZ   HLOOK        ;IF NOT, WAIT FOR NEXT BYTE
00DD 3E09            MVI   A,09H        ;ELSE, ADJUST INCOME COUNTER
00DF 32A44F          STA   INCOME
```

```
00E2 3AA44F   HLOOK2: LDA   INCOME   ;GET HEADEF C[illegible]
00E5 A7               ANA   A        ;SEE IF [illegible]
00E6 CAFC00           JZ    DLOOK    ;IF NOT, [illegible]
00E9 47               MOV   B,A      ;ELSE, PUT COUNT INTO REG. B
00EA 3A0590   AGAIN:  LDA   ASTAT    ;GET STATUS FROM 8250
00ED E601             ANI   01H      ;MASK TO GET DR FLAG
00EF 3200E0           STA   RESET    ;HIT RESET CIRCUITRY
00F2 CAEA00           JZ    AGAIN    ;IF NO DATA READY, LOOK AGAIN
                      ;
00F5 3A0090           LDA   ADATA    ;READ CHARACTER TO RESET DR
00F8 05               DCR   B        ;DECREMENT HEADER COUNTER
00F9 C2EA00           JNZ   AGAIN
                      ;
              ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
              ;
              ;LOOK FOR DATA, HEADER ALREADY REMOVED.
              ;
              ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
00FC 3A0590   DLOOK:  LDA   ASTAT    ;GET 8250 STATUS
00FF E601             ANI   01H      ;
0101 3200E0           STA   RESET    ;HIT RESET CIRCUITRY
0104 CAFC00           JZ    DLOOK    ;IF NO DATA AVAILABLE, WAIT
0107 3A0090   INP:    LDA   ADATA    ;GET DATA BYTE
010A FE20             CPI   20H      ;IS IT A SPACE
010C CAFC00           JZ    DLOOK    ;IF SO, GET NEXT BYTE
010F 320080           STA   8000H    ;OUTPUT TO CRT
0112 FE0D             CPI   0DH      ;IS IT A CR
0114 CAFC00           JZ    DLOOK    ;IF SO, GET NEXT BYTE
0117 FE0A             CPI   0AH      ;IS DATA A LF
0119 C8               RZ             ;IF SO, PACKET COMPLETE
011A 77               MOV   M,A      ;IF NOT, STORE DATA IN RAM
011B 23               INX   H        ;INCREMENT INPUT POINTER
011C C3FC00           JMP   DLOOK    ;GET NEXT DATA BYTE
              ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
              ; THIS ROUTINE INPUTS DATA, ELIMINATES THE PACKET HEADER AND
              ; STORES THE DATA IN RAM. INPUT FROM 8250.
              ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                      ;
                      ;
011F F5       DATAIN: PUSH  PSW      ;SAVE CPU STATUS WORD
0120 3E10             MVI   A,10H    ;RESET RST 7.5
0122 30               SIM
0123 2AA24F           LHLD  POINTI   ;GET CURRENT INPUT POINTER
0126 3A0590           LDA   ASTAT    ;GET STATUS FROM 8250
0129 E601             ANI   01H      ;IS THERE INPUT DATA PENDING
012B CA7701           JZ    RETFLG   ;IF NOT, RETURN
012E 3AA44F   INPUTD: LDA   INCOME   ;ELSE DATA IS PRESENT, SEE IF HEADER
                                     ;IS STILL PRESENT
0131 A7               ANA   A        ;IS IT ZERO
0132 CA3E01           JZ    DIN      ;IS SO, VALID DATA IS PRESENT, GET IT
0135 3D               DCR   A        ;ELSE, DECREMENT COUNT
0136 32A44F           STA   INCOME   ;STORE HEADER COUNT
0139 3A0090           LDA   ADATA    ;DO A DUMMY READ TO CLEAR INTERRUPT
013C F1               POP   PSW      ;RESTORE CPU STATUS WORD
013D C9               RET
013E 3A0090   DIN:    LDA   ADATA    ;GET DATA B[illegible]
```

```
0141 FE20                CPI     20H          ;IS IT A SPACE
0143 CA7701              JZ      RETFLG
0146 320080              STA     8000H        ;OUTPUT TO CRT
0149 FE0D                CPI     0DH          ;IS IT A CR
014B CA7701              JZ      RETFLG
014E FE0A                CPI     0AH          ;IS IT A LF
0150 CA5A01              JZ      INDONE       ;IF SO, INPUT PACKET COMPLETE
0153 77                  MOV     M,A          ;ELSE, VALID DATA, STORE IN RAM
0154 23                  INX     H
0155 22A24F              SHLD    POINTI       ;STORE UPDATED INPUT POINTER
0158 F1                  POP     PSW          ;RESTORE FLAGS
0159 C9                  RET
015A 3E0C       INDONE:  MVI     A,0CH        ;RESET HEADER COUNT
015C 32A44F              STA     INCOME
015F 3AAD4F              LDA     PACKET       ;GET CURRENT PACKET COUNT
0162 FED0                CPI     0D0H         ;HAS MAX. PACKET COUNT BEEN REACHED
0164 CA7101              JZ      RETRES       ;IF SO, RESET INPUT POINTERS AND RETURN
0167 3C                  INR     A            ;ELSE, INCREMENT PACKET COUNT
0168 32AD4F              STA     PACKET       ;STORE NEW VALUE
016B CD7901              CALL    UP13         ;INCREMENT INPUT POINTERS TO NEXT BLOCK
016E C37701              JMP     RETFLG       ;RETURN TO MAIN BODY
0171 2AB54F     RETRES:  LHLD    PTINP        ;GET CURRENT INPUT BASE POINTER
0174 22A24F              SHLD    POINTI       ;RESET INPUT POINTER TO OVERWRITE
0177 F1         RETFLG:  POP     PSW          ;RESTORE CPU STATUS WORD BEFORE RETURNING
0178 C9                  RET
                         ;
                         ;
                ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                ; THIS ROUTINE INCREMENTS THE INPUT POINTERS IN INCREMENTS OF 13H. THIS
                ; ROUTINE ALSO INSURES THE POINTERS ARE IN BUFFER RANGE.
                ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                         ;
                         ;
0179 3E13       UP13:    MVI     A,13H        ;VALUE TO BE INCREMENTED
017B 2AB54F              LHLD    PTINP        ;GET LAST BASE INPUT POINTER
017E 85                  ADD     L            ;INCREMENT TO NEXT INPUT BASE
017F 6F                  MOV     L,A          ;PUT INCREMENTED VALUE BACK INTO L
0180 3E00                MVI     A,00H        ;CLEAR A
0182 8C                  ADC     H            ;ADD CARRY TO REGISTER H
0183 67                  MOV     H,A          ;RESTORE UPDATE VALUE
0184 CDF901              CALL    OVERFL       ;INSURE POINTERS ARE STILL IN RANGE
0187 22B54F              SHLD    PTINP        ;STORE NEW INPUT POINTERS
018A 22A24F              SHLD    POINTI
018D C9                  RET
                         ;
                         ;
                ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                ; THIS ROUTINE OUTPUTS A SINGLE DATA BYTE TO THE 8273 UPON
                ; REQUEST, THIS ROUTINE ALSO CHECKS FOR TRANSMISSION ERRORS AND
                ; END-OF-MESSAGE INTERRUPTS.
                ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                         ;
                         ;
                         ;
018E 3A0050     OUTDAT:  LDA     SSTAT        ;GET STATUS FROM 8273
0191 32B24F              STA     STATUS       ;STORE CURRENT STATUS
0194 E601                ANI     01H          ;IS THERE AN INTERRUPT RESULT AVAIL.
```

```
0196 CAED01                JZ      OUTBYT        ;IF NOT, OUTPUT DATA BYTE
0199 3AB24F                LDA     STATUS        ;GET PREVIOUSLY READ STATUS BYTE
019C E610                  ANI     10H           ;IS THERE AN IMMEDIATE RESULT AVAIL.
019E CAA501                JZ      CONT          ;IF NOT CONTINUE ON
01A1 3A0160                LDA     6001H         ;IF SO, READ RESULT
01A4 C9                    RET
01A5 3A0260      CONT:     LDA     TXIR          ;READ INTERRUPT RESULT BYTE
01A8 FE0D                  CPI     0DH           ;IS PACKET COMPLETE AND ERROR FREE
01AA C2B601                JNZ     BAD           ;IF NOT, GOTO TO BAD
01AD 3E00                  MVI     A,00H         ;RESET NO ACK. FLAG
01AF 32A64F                STA     ACKFLG
01B2 C3C201                JMP     STATLP        ;CHECK AGAIN
01B5 00                    NOP                   ;TURN RECEIVER ON AT THIS POINT
01B6 3EFF        BAD:      MVI     A,0FFH        ;SET NO ACK FLAG
01B8 32A64F                STA     ACKFLG
01BB 2AA04F                LHLD    POINTO        ;LOAD ORIGINAL OUTPUT POINTER
01BE 22B34F                SHLD    CURRENT       ;STORE IN CURRENT OUTPUT POINTER LOC.
01C1 00                    NOP                   ;SINCE PACKET IS BAD, PREPARE TO RETRANS.
01C2 3A0060      STATLP:   LDA     SSTAT         ;GET STATUS BYTE TO CHECK FOR RESULTS
01C5 E601                  ANI     01H           ;ARE THERE ANY MORE RESULTS AVAILABLE
01C7 CAD001                JZ      TURNON        ;IF NO RESULTS, RETURN (RZ)
01CA 3A0260                LDA     TXIR          ;READ INTERRUPT RESULT BYTE
01CD C3C201                JMP     STATLP        ;CHECK FOR MORE RESULT BYTES
01D0 3AA64F      TURNON:   LDA     ACKFLG        ;GET ACK FLAG
01D3 A7                    ANA     A             ;IS AN ACK EXPECTED
01D4 CADC01                JZ      RXON          ;IF SO, PREPARE TO TURN ON RECEIVER
01D7 217400      TXON:     LXI     H,TXSTRT      ;LOAD HL WITH RETURN ADDRESS
01DA E3                    XTHL                  ;PUT ON TOP OF STACK
01DB C9                    RET
01DC 218600      RXON:     LXI     H,ACKLOP      ;PUT ACKLOP PROGRAM LOCATION INTO HL
01DF E3                    XTHL                  ;REPLACE WITH TOP OF STACK
01E0 3E0A                  MVI     A,0AH         ;SET INTR. MASK TO RECEIVE
01E2 30                    SIM
01E3 216A03                LXI     H,RCV         ;TURN-ON RECEIVER
01E6 CD3903                CALL    CMDOUT        ;OUTPUT TURN-ON COMMANDS
01E9 01B90A                LXI     B,0AB9H       ;SET-UP TIME-OUT COUNTER, 24MS WAIT
01EC C9                    RET
01ED 2AB34F      OUTBYT:   LHLD    CURRENT       ;GET CURRENT OUTPUT DATA POINTER
01F0 7E                    MOV     A,M           ;PUT DATA BYTE INTO A
01F1 320070                STA     SDATAO        ;OUTPUT DATA TO 8273
01F4 23                    INX     H
01F5 22B34F                SHLD    CURRENT       ;STORE UPDATED OUPUT POINTER
01F8 C9                    RET
                 ;
                 ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                 ; THIS ROUTINE CHECKS THE POINTER VALUE IN THE H&L REGISTER
                 ; PAIR TO INSURE THAT IT IS NOT OUT-OF-RANGE
                 ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                 ;
                 ;
01F9 7D          OVERFL:   MOV     A,L           ;MOVE LSB OF POINTER INTO A
01FA FE70                  CPI     70H
01FC C0                    RNZ
01FD 7C                    MOV     A,H           ;MOVE MSB OF POINTER INTO A
01FE FE4F                  CPI     4FH
0200 C0                    RNZ
0201 210040                LXI     H,RAM         ;IF POINTER IS 4F70H, RESET TO TOP
```

```
                                          ;OF RAM
0204 C9                  RET
                         ;
                         ;
     ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
     ; THIS ROUTINE INPUTS A DATA BYTE FROM THE 8273, THIS ROUTINE
     ; ALSO CHECKS FOR TRANSMISSIONS ERRORS AS WELL AND THE END-
     ; OF-MESSAGE FLAG.
     ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                         ;
                         ;
0205 3E0A      GETACK:   MVI    A,0AH     ;SET INTERRUPT MASK TO OUTPUT
0207 30                  SIM              ;TO CRT.
0208 3A0060              LDA    SSTAT     ;GET STATUS WORD FROM 8273
020B 32B24F              STA    STATUS    ;STORE STATUS WORD
020E E602                ANI    02H       ;IS THERE A RECEIVER INTERRUPT RESULT
0210 CA8102              JZ     INBYTE    ;IF NOT, INPUT DATA IS AVAILABLE
0213 3AB24F              LDA    STATUS    ;ELSE, READ STATUS BYTE & DETERMINE RESULT
0216 E610                ANI    10H       ;IS IT AN IMMEDIATE RESULT
0218 CA2202              JZ     CONTR     ;IF NOT CONTINUE
021B 3A0160              LDA    RESULT    ;ELSE, READ RESULT
021E 01B90A              LXI    B,0AB9H   ;RESTORE TIME-OUT COUNTER
0221 C9                  RET
0222 3A0360    CONTR:    LDA    RXIR      ;READ RECEIVER INTERRUPT RESULT
0225 FE03                CPI    03H       ;SEE IF CRC ERROR HAS OCCURRED
0227 CA6402              JZ     DATCRC    ;IF SO, DETERMINE TYPE
022A E60F                ANI    0FH       ;IS PACKET RECEIVED COMPLETE AND ERROR FREE
022C C24E02              JNZ    BADR      ;IF NOT, GOTO BAD RECEIVE
022F 0E04      GOODR:    MVI    C,04H     ;SET-UP COUNTER TO GET PACKET ID
0231 20        RL1:      RIM              ;CHECK INTERRUPTS
0232 E640                ANI    40H       ;SEE IF INPUT DATA IS AVAILABLE
0234 C25C02              JNZ    RXCALL    ;IF SO, PREPARE TO GET DATA BYTE
0237 3A0060    RL2:      LDA    SSTAT     ;GET SYNC. STATUS WORD
023A E602                ANI    02H       ;IS A RESULT AVAILABLE
023C CA3102              JZ     RL1       ;IF NOT, WAIT
023F 3A0360              LDA    RXIR      ;GET RESULT
0242 0D                  DCR    C         ;DECREMENT COUNTER
0243 C23102              JNZ    RL1       ;IF NOT ID BYTE, GET NEXT RESULT
0246 47                  MOV    B,A       ;ELSE IT IS ID, PUT INTO B
0247 3AAC4F              LDA    ID        ;GET TRANSMITTED ID
024A B8                  CMP    B         ;ARE THEY THE SAME
024B CA7302              JZ     GOODTX    ;IF SO, THE TRANSMISSION WAS RECEIVED
024E 2AA04F    BADR:     LHLD   POINTO    ;ELSE, IT WAS NOT PROPERLY RECEIVED
0251 22B34F              SHLD   CURRENT   ;RESET POINTERS TO RETRANSMIT
0254 3EFF                MVI    A,0FFH    ;SET NO ACK. FLAG
0256 32A64F              STA    ACKFLG
0259 C39802              JMP    RSTAT
                         ;
025C C5        RXCALL:   PUSH   B         ;PUT RECEIVE PACKET ID COUNTER ON STACK
025D CD1F01              CALL   DATAIN    ;GET DATA BYTE
0260 C1                  POP    B         ;PULL PACKET ID COUNT OFF OF STACK
0261 C33702              JMP    RL2       ;CONTINUE CHECKING STATUS OF 8273
                         ;
0264 3AA64F    DATCRC:   LDA    ACKFLG    ;GET ACKFLG TO SEE IF DATA HAS BEEN RECEIVED
0267 FEAA                CPI    0AAH      ;IF ACKFLG=0AAH, DATA HAS BEEN RECEIVED
0269 CA4E02              JZ     BADR      ;IF SO, THEN PACKET IS IN ERROR
026C 3E00                MVI    A,00H     ;ELSE, FLASE CRC ERROR WAS DETECTED
```

```
026E 30                  SIM
026F 01B90A              LXI    B,0AB9H        ;RESET TIME-OUT COUNTER
0272 C9                  RET                   ;CONTINUE LOOKING FOR ACK.
0273 3AB04F     GOODTX:  LDA    ACKBYT         ;GET ACK. BYTE
0276 FEA5                CPI    0A5H           ;WAS IT A POSITIVE ACKNOWLEDGEMNET
0278 C24E02              JNZ    BADR           ;IF NOT, SET-UP FOR RETRANSMISSION
027B 2AB34F              LHLD   CURRENT        ;GET CURRENT OUTPUT POINTER
027E CDF901              CALL   OVERFL         ;INSURE POINTER IS WITHIN RANGE
0281 22B34F              SHLD   CURRENT
0284 22A04F              SHLD   POINTO         ;STORE UPDATED POINTERS
0287 3AAC4F              LDA    ID             ;GET CURRENT PACKET ID NUMBER
028A 3C                  INR    A              ;INCREMENT ID NUMBER FOR NEXT TRANSMISSION
028B 32AC4F              STA    ID             ;STORE NEW ID NUMBER
028E 3AAD4F              LDA    PACKET         ;GET CURRENT PACKET COUNT
0291 3D                  DCR    A              ;DECREMENT THAT VALUE
0292 32AD4F              STA    PACKET         ;STORE NEW VALUE
0295 CAC402              JZ     EMPTY          ;IF PACKET COUNT=0, BUFFER IS EMPTY
                         ;
0298 216803     RSTAT:   LXI    H,DR           ;TURN-OFF RECEIVER
029B CD3903              CALL   CMDOUT
029E 3E09                MVI    A,09H          ;SET INTERRUPT MASK FOR TRANSMISSION
02A0 30                  SIM
02A1 217400              LXI    H,TXSTRT       ;LOAD HL WITH RECEIVER TURN-ON COMMAND LINE
02A4 E3                  XTHL                  ;REPLACE THAT ADDRESS WITH STACK
02A5 3A0060     RSTATL:  LDA    SSTAT          ;READ STATUS
02A8 E602                ANI    02H            ;ANY RXIR AVAILABLE
02AA C8                  RZ                    ;IF NO RESLUTS, RETURN
02AB 3A0360              LDA    RXIR           ;ELSE, READ INTERRUPT RESULT
02AE C3A502              JMP    RSTATL         ;CHECK TO SEE IF ANY MORE RESULTS EXIST
                         ;
02B1 2AB34F     INBYTE:  LHLD   CURRENT        ;GET CURRENT INPUT POINTER
02B4 3A00B0              LDA    SDATAI         ;GET INPUT DATA BYTE
02B7 32B04F              STA    ACKBYT         ;STORE ACKNOWLEDGEMENT BYTE
02BA 01B90A              LXI    B,0AB9H        ;RESTORE TIME-OUT COUNTER, 24MS
02BD 3EAA                MVI    A,0AAH         ;PUT 0AAH IN ACKFLG TO SHOW DATA RECEIVED
02BF 32A64F              STA    ACKFLG
02C2 A7                  ANA    A              ;RESET ZERO FLAG IN CPU STATUS WORD
02C3 C9                  RET
                         ;
02C4 216803     EMPTY:   LXI    H,DR           ;DISABLE RECEIVER
02C7 CD3903              CALL   CMDOUT
02CA 3E08                MVI    A,08H          ;SET INTERRUPT MASK, ENABLE 7.5
02CC 30                  SIM
02CD 21BA00              LXI    H,INLOOP       ;SINCE RAM IS EMPTY, GET A COMPLETE PACKET
02D0 E3                  XTHL
02D1 C3A502              JMP    RSTATL
                         ;
                         ;
    ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
    ; THE ROUTINES BELOW INITIALIZE THE SERIAL CHIPS
    ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                         ;
                         ;
02D4 3E80       I82501:  MVI    A,80H          ;SET-UP TO LOAD BAUD DIVISOR
02D6 320390              STA    LCR            ;WRITE TO LCR, SET DLAB=1
02D9 3E68                MVI    A,68H          ;LSB OF DIVISOR, 8MHZ CRYSTAL
```

```
02DB 320090      445         STA     BAUDLS          ;4FH FOR 6MHZ CRYSTAL
02DE 3E00        446         MVI     A,00H           ;MSB OF DIVISOR
02E0 320190      447         STA     BAUDMS
02E3 3E07        448         MVI     A,07            ;8-BITS, NO PARITY, 2 STOP BITS
02E5 320390      449         STA     LCR             ;SET-UP OPERATING CONDITIONS
02E8 3E00        450         MVI     A,00H
02EA 320590      451         STA     ASTAT           ;CLEAR LINE STATUS REGISTER
02ED 3E01        452         MVI     A,01H           ;ENABLE DATA AVAILABLE INTERRUPT
02EF 320190      453         STA     DISINR          ;INTERRUPT ENABLE REGISTER
02F2 3E0F        454         MVI     A,0FH           ;ACTIVATE MODEM CONTROL LINES
02F4 320490      455         STA     LCR+1
02F7 C9          456         RET
                 457 ;
                 458 ;
02F8 215D03      459 I6273:  LXI     H,OPMODES
02FB CD3903      460         CALL    CMDOUT
02FE 215F03      461         LXI     H,SMODES
0301 CD3903      462         CALL    CMDOUT
0304 216203      463         LXI     H,STATS
0307 CD3903      464         CALL    CMDOUT
030A 216503      465         LXI     H,BITS
030D CD3903      466         CALL    CMDOUT
0310 216A03      467         LXI     H,RCV
0313 CD3903      468         CALL    CMDOUT
0316 C9          469         RET
                 470 ;
                 471 ;
0317 3E80        472 I82502: MVI     A,80H           ;SET-UP TO LOAD BAUD DIVISOR
0319 320380      473         STA     8003H           ;WRITE TO LCR, SET DLAB=1
031C 3E68        474         MVI     A,68H           ;LSB OF DIVISOR, 6MHZ CRYSTAL
031E 320080      475         STA     8000H           ;4FH FOR 6MHZ CRYSTAL
0321 3E00        476         MVI     A,00H           ;MSB OF DIVISOR
0323 320180      477         STA     8001H
0326 3E07        478         MVI     A,07            ;8-BITS, NO PARITY, 2 STOP BITS
0328 320380      479         STA     8003H           ;SET-UP OPERATING CONDITIONS
032B 3E00        480         MVI     A,00H
032D 320180      481         STA     8001H           ;CLEAR LINE STATUS REGISTER
0330 320580      482         STA     8005H           ;DISABLE INTERRUPTS
0333 3E0F        483         MVI     A,0FH
0335 320480      484         STA     8004H
0338 C9          485         RET
                 486 ;
0339 0E30        487 CMDOUT: MVI     C,30H
033B 46          488         MOV     B,M
033C 23          489         INX     H
033D 3A0060      490 CMD1:   LDA     SSTAT
0340 07          491         RLC
0341 DA3D03      492         JC      CMD1
0344 7E          493         MOV     A,M
0345 320060      494         STA     SCMDRG
0348 78          495 CMD2:   MOV     A,B
0349 A7          496         ANA     A
034A C8          497         RZ
034B 23          498         INX     H
034C 05          499         DCR     B
034D 3A0060      500 CMD3:   LDA     SSTAT
0350 E620        501         ANI     20H
```

```
0352 C24D03       502         JNZ     CMD3
0355 7E           503         MOV     A,M
0356 320160       504         STA     SPRMRG
0359 C34803       505         JMP     CMD2
                  506 ;
                  507 ;
035C 01           508 OPMODES:        DB      01,91H,00000111B
035D 91
035E 07
035F 01           509 SMODES:         DB      01,0A0H,000000000B
0360 A0
0361 00
0362 01           510 DTAXS:          DB      01,97H,000000001B
0363 97
0364 01
0365 01           511 BITS:           DB      01,0A4H,000000005
0366 A4
0367 00
0368 00           512 DR:             DB      00,0C5H
0369 C5
036A 02           513 RCV:            DB      02,0C0H,01H,00H
036B C0
036C 01
036D 00
                  514 ;
                  515 ;
                  516 ;
036E 3E04         517 IXMIT:  MVI     A,04H           ;FOUR PARAMETERS IN COMMAND
0370 32A74F       518         STA     XMIT            ;STORE IN RAM
0373 3EC8         519         MVI     A,0C8H          ;GENERAL TRANSMIT COMMAND
0375 32A84F       520         STA     XMIT+1
0378 3E13         521         MVI     A,13H           ;LSB OF PACKET LENGTH
037A 32A94F       522         STA     XMIT+2
037D 3E00         523         MVI     A,00H           ;MSB OF PACKET LENGTH
037F 32AA4F       524         STA     XMIT+3
0382 3EFF         525         MVI     A,0FFH          ;ADDRESS BYTE TO BE SENT
0384 32AB4F       526         STA     XMIT+4
0387 C9           527         RET
                  528 ;
                  529         END
```

USER SYMBOLS

ACKBYT	A 4FB0	ACKFLG	A 4FA6	ACKLOP	A 0086	ACKLP2	A 008C	ADATA	A 9000	AGAIN	A 00EA
ASTAT	A 9005	BAD	A 01B6	BADR	A 024E	BAUDLS	A 9000	BAUDMS	A 9001	BEGIN	A 0040
BITS	A 0365	BUFFER	A 4000	CMD1	A 033D	CMD2	A 0348	CMD3	A 034D	CMDOUT	A 0339
CNTRL	A 4FAC	CONT	A 01A5	CONTR	A 0222	COUNTS	A FF0C	CRTBUF	A 4FB1	CURREN	A 4FB3
DATAIN	A 011F	DATCRC	A 0264	DIN	A 013E	DISINR	A 9001	DLOOK	A 00FC	DR	A 0368
DTAXS	A 0362	EMPTY	A 02C4	GETACK	A 0205	GOODR	A 022F	GOODTX	A 0273	HLOOK	A 00CA
HLOOK2	A 00E2	I82501	A 02D4	I82502	A 0317	I8273	A 02F8	ID	A 4FAC	INBYTE	A 02B1
INCOME	A 4FA4	INDONE	A 015A	INLOOP	A 008A	INP	A 0107	INPUTD	A 012E	IXMIT	A 036E
LCR	A 9003	MAIN	A 005C	MLOOP	A 007E	NOACK	A 00A2	OPMODE	A 035C	OUTBYT	A 01ED
OUTDAT	A 018E	OVERFL	A 01F9	PACKET	A 4FAD	POINTI	A 4FA2	POINTO	A 4FA0	PTINP	A 4FB5
RAM	A 4000	RCV	A 036A	RESET	A E000	RESULT	A 6001	RETFLG	A 0177	RETRES	A 0171
RL1	A 0231	RL2	A 0237	RSTAT	A 0298	RSTATL	A 02A5	RXCALL	A 025C	RXIR	A 6003
RXON	A 01DC	SCMDRG	A 6000	SDATAI	A B000	SDATAO	A 7000	SMODES	A 035F	SPRMRG	A 6001
SSTAT	A 6000	STATLP	A 01C2	STATUS	A 4FB2	TIME	A 4FB7	TURNON	A 01D0	TXIR	A 6002
TXON	A 01D7	TXSTAT	A 4FA5	TXSTRT	A 0074	UP13	A 0179	XMIT	A 4FA7		

ASSEMBLY COMPLETE, NO ERRORS

APPENDIX II

```
ISIS-II 8080/8085 MACRO ASSEMBLER, V4.1        MODULE   PAGE    1

LOC  OBJ        SOURCE STATEMENT

          ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
          ;     COPYRIGHT 1985 ZENITH ELECTRONICS CORP.
          ;THIS PROGRAM WAS WRITTEN GORDON E. REICHARD ON JUNE 12, 1985
          ; THIS IS ONLY A PRELIMINARY VERSION OF THE PROGRAM.
          ; THE PROGRAM IS CALLED Z-TLM300. THE NAME TLM300 IS THE
          ; DIRECTORY NAME.
          ; THIS PROGRAM IS USED TO RECEIVE DATA FROM THE Z-TCU100
          ; LOCATION AT THE CENTRAL OFFICE. THE DATA FROM THAT POINT
          ; IS CONVERTED, BUFFERED, AND LASTLY TRANSFERRED TO THE MUX
          ; BOARD.
          ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                  ;
                  ;
          ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
          ; WHEN THE VARIABLE 'AREA' IS SET TO FOH, THE PROGRAM 'TABLE'
          ; MUST BE USED TO PROGRAM THE 2732 EPROM (IC 7) WITH THE
          ; CORRECT AREA CODE CONVERSIONS.
          ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                  ;
                  ;
          ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
          ; BELOW ARE THE EQUATE STATEMENTS ASSIGNING LABELS TO ADDRESS
          ; VALUES.
          ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                  ;
                  ;
9000      ADATA   EQU    9000H        ;ASYNC  DATA PORT, 8250
9000      BAUDLS  EQU    ADATA        ;LSB OF BAUD RATE
9001      BAUDMS  EQU    ADATA+1      ;MSB OF BAUD RATE
9003      LCR     EQU    ADATA+3      ;LINE CONTROL REG. 8250
9001      DISINR  EQU    ADATA+1      ;DISABLE INTERRUPT REG. 8250
9005      ASTAT   EQU    ADATA+5      ;ASYNC STATUS PORT, 8250
4000      RAM     EQU    4000H
4000      BUFFER  EQU    RAM          ;IN AND OUT BUFFER
6000      SCMDRG  EQU    6000H        ;SYNC COMMAND REG. 8273
6000      SSTAT   EQU    SCMDRG       ;SYNC STATUS REG. 8273
6001      SPRMRG  EQU    SCMDRG+1     ;SYNC PARAMETER REG.
6001      RESULT  EQU    SPRMRG       ;RESULT REGISTER
6002      TXIR    EQU    SCMDRG+2     ;TRANSMIT INTERRUPT REG.
6003      RXIR    EQU    SCMDRG+3     ;RECEIVER INTERRUPT REG.
4FA0      POINTO  EQU    4FA0H        ;OUTPUT POINTER
4FA2      POINTI  EQU    POINTO+2     ;INPUT POINTER
7000      SDATAO  EQU    7000H        ;SYNC DATA OUTPUT, 8273
8000      SDATAI  EQU    08000H       ;SYNC DATA INPUT, 8273
4FA4      INCOME  EQU    POINTI+2     ;INCOMING DATA PACKET PENDING
4FA5      TXSTAT  EQU    POINTI+3     ;CURRENT 8273 X-MIT STATUS
4FA6      ACKFLG  EQU    POINTI+4     ;ACKNOWLEDGEMENT FLAG
4FA7      XMIT    EQU    POINTI+5     ;START ADDRESS OF X-MIT SET-UP
4FAC      CNTRL   EQU    XMIT+5       ;CONTROL FIELD FOR SDLC FRAME
```

```
4FA5      PACKET  EQU   POINTIZ+11    ;PACKETS REMAINING IN RAM
4FB7      GETID   EQU   4FB7H         ;INPUT DATA COUNTER, USED FOR GETTING ID
4FB6      CRTBUF  EQU   4FB6H         ;DATA HERE IS OUTPUT TO CRT
4FB5      STATUS  EQU   4FB5H         ;STATUS BYTE READ FROM 8273
4FB3      CURRENT EQU   4FB3H         ;CURRENT OUTPUT POINTER (ALSO 4FB4H)
E000      RESET   EQU   0E000H        ;WATCH DOG RESET CIRCUIT ADDRESS
                  ;
00F0      AREA    EQU   0F0H          ;MSB BASE OF AREA CODE LOOK-UP TABLE
                                      ;THIS VALUE SHOULD BE 10H FOR PROTO-TYPE USE
                                      ;AND F0H FOR PRODUCTION USE.
4026      TOPOUT  EQU   4026H         ;STARTING ADDRESS OF OUTPUT BUFFER
4F8A      CNVRTP  EQU   4F8AH         ;LOCATION TO STORE CONVERTER POINTER
4F8C      TXFLG   EQU   4F8CH         ;LOCATION OF OUTPUT BUFFER READY FLAG
4F8D      DATAVA  EQU   4F8DH         ;FLAG TO DETERMINE WHETHER DATA IS AVA. FOR CK.
4F8E      SAMPAC  EQU   4F8EH         ;LOCATION WHICH HOLD REPEAT PACKET COUNT
4F8B      CNVRTH  EQU   CNVRTP+1      ;THIS LOCATION CONTAINS THE H REG.
4F90      HPCNVT  EQU   4F90H         ;BASE POINTER FOR DATA CONVERSION
4F92      HPSAVE  EQU   HPCNVT+2      ;OFFSET DATA CONVERSION POINTER
4F94      BYTE12  EQU   HPCNVT+4      ;HP OUTPUT, BYTES 1 AND 2
4F96      BYTE34  EQU   HPCNVT+6      ;BYTES 3 AND 4
4F98      BYTE56  EQU   HPCNVT+8      ;BYTES 5 AND 6
4F9A      BYTE78  EQU   HPCNVT+0AH    ;BYTES 7 AND 8
4F9C      VALUE   EQU   HPCNVT+0CH    ;LOCATION WHERE MULTIPLIED VALUE IS SAVED
4F9E      CNVBUF  EQU   HPCNVT+0EH    ;CONVERTER BUFFER FULL FLAG LOCATION
00FF      MUXRUN  EQU   0FFH          ;MUX COUNTER RUNNING AND NO RESET
001F      MRESET  EQU   1FH           ;RESET SIGNAL FOR THE MUX BOARD
002F      MSTOP   EQU   2FH           ;MUX STOP COUNTER SIGNAL
                  ;
4FBA      ADDRES  EQU   4FBAH         ;ACK. PACKET ADDRESS BYTE LOCATION
4FBB      ID      EQU   ADDRES+1      ;PACKET ID BYTE LOCATION
4FBC      TXBYTE  EQU   ADDRES+2      ;ACKNOWLEDGE BYTE. A5=GOOD. C3=BAD
4FBD      TXPNT   EQU   ADDRES+3      ;ACK. OUTPUT BUFFER POINTER
                  ;
0010      PORT4A  EQU   10H           ;IC4, 8255 PORT A
0011      PORT4B  EQU   11H           ;IC4, 8255 PORT B
0012      PORT4C  EQU   12H           ;IC4, 8255 PORT C
0013      CPORT4  EQU   13H           ;IC4, 8255 CONTROL PORT
0020      PORT5A  EQU   20H           ;IC5, 8255 PORT A
0023      CPORT5  EQU   23H           ;IC5, 8255 CONTROL PORT
D000      MUXWR   EQU   0D000H        ;USE THIS ADDRESS TO WRITE TO MUX BOARD
                  ;
                  ;
          ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
          ; THIS IS THE LOOK-UP TABLE FOR THE AREA CODES.
          ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                  ;
                  ;
1314              ORG   1314H
1314 3F           DB    00111111B     ;314 AREA CODE
                  ;
1312              ORG   1312H
1312 7F           DB    01111111B     ;312 AREA CODE
                  ;
1815              ORG   1815H
1815 BF           DB    10111111B     ;815 AREA CODE
                  ;
```

```
1414                   ORG     1414H
1414 FF                DB      11111111B        ;414 AREA CODE
                       ;
                       ;
            ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
            ; THIS IS THE LOOK-UP TABLE CONTAINING THE MULTIPLIERS USED
            ; BYTE THE MULTI SUB-ROUTINE.
            ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                       ;
                       ;
0A00                   ORG     0A00H            ;LOOK-UP TABLE FOR ASCII CNVERSION
0A00 0000    LT1000:   DW      0000H            ;0000
0A02 E803              DW      03E8H            ;1000
0A04 D007              DW      07D0H            ;2000
0A06 B80B              DW      0BB8H            ;3000
0A08 A00F              DW      0FA0H            ;4000
0A0A 8813              DW      1388H            ;5000
0A0C 7017              DW      1770H            ;6000
0A0E 581B              DW      1B58H            ;7000
0A10 401F              DW      1F40H            ;8000
0A12 2823              DW      2328H            ;9000
                       ;
0B00                   ORG     0B00H
0B00 0000    LT100:    DW      0000H            ;000
0B02 6400              DW      0064H            ;100
0B04 C800              DW      00C8H            ;200
0B06 2C01              DW      012CH            ;300
0B08 9001              DW      0190H            ;400
0B0A F401              DW      01F4H            ;500
0B0C 5802              DW      0258H            ;600
0B0E BC02              DW      02BCH            ;700
0B10 2003              DW      0320H            ;800
0B12 8403              DW      0384H            ;900
                       ;
0C00                   ORG     0C00H
0C00 00      LT10:     DB      00H              ;00
0C01 0A                DB      0AH              ;10
0C02 14                DB      14H              ;20
0C03 1E                DB      1EH              ;30
0C04 28                DB      28H              ;40
0C05 32                DB      32H              ;50
0C06 3C                DB      3CH              ;60
0C07 46                DB      46H              ;70
0C08 50                DB      50H              ;80
0C09 5A                DB      5AH              ;90
                       ;
                       ;
                       ;
                       ;
            ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
            ; THIS IS THE BEGINNING OF THE PROGRAM. THIS PORTION OF THE
            ; PROGRAM TO THE START OF THE MAIN BODY OF THE PROGRAM PERFORMS
            ; REGITER AND CHIP INITIALIZATION.
            ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                       ;
                       ;
```

```
0000                ORG    0000H
0000 F3             DI
0001 3E1E           MVI    A,1EH          ;EN-[illegible]
0003 30             SIM                   ;SET INTERRUPT MASK
0004 210040         LXI    H,RAM          ;SET ALL POINTERS TO TOP OF RAM
0007 22B34F         SHLD   CURRENT
000A 22A24F         SHLD   POINTI
000D 22A04F         SHLD   POINTO
0010 22904F         SHLD   HPCNVT
0013 22924F         SHLD   HPSAVE
0016 21BA4F         LXI    H,ADDRES
0019 22BD4F         SHLD   TXPNT          ;SET ACK. TRANSMIT OUTPUT POINTER
001C 212640         LXI    H,TOPOUT
001F 228A4F         SHLD   CNVRTP         ;SET-UP OUTPUT BUFFER POINTER
0022 C34000         JMP    BEGIN
                    ;
002C                ORG    002CH          ;RST 5.5
002C C30701         JMP    INPDAT
                    ;
0034                ORG    0034H          ;RST 6.5
0034 C3ED01         JMP    OUTACK
                    ;
003C                ORG    003CH          ;RST 7.5
003C C38102         JMP    OUTCRT
                    ;
0040                ORG    0040H          ;BEGINNING OF MAIN PROGRAM
0040 01FFFF  BEGIN: LXI    B,0FFFFH
0043 3200E0  TL1:   STA    RESET          ;HIT RESET CIRCUIT
0046 0B             DCX    B
0047 78             MOV    A,B
0048 A7             ANA    A
0049 C24300         JNZ    TL1
004C 79             MOV    A,C
004D A7             ANA    A
004E C24300         JNZ    TL1
0051 310050  START: LXI    SP,5000H       ;SET STACK POINTER TO TOP
0054 CD9902         CALL   I82501
0057 CDDC02         CALL   I82502
005A CDBD02         CALL   I8273
005D CD3303         CALL   IXMIT          ;SET-UP OUTPUT ARRAY
0060 CD4803         CALL   I8255
0063 3E00           MVI    A,00H
0065 32BB4F         STA    ID             ;STORE PACKET ID
0068 32AD4F         STA    PACKET         ;ZERO PACKET COUNT
006B 32B74F         STA    GETID          ;RESET DATA COUNTER TO GET ID
006E 329E4F         STA    CNVBUF         ;RESET CONVERT BUFFER EMPTY FLAG
0071 328C4F         STA    TXFLG          ;NO DATA READY FOR TRANSFER TO HP
0074 3E0F           MVI    A,0FH          ;SET REPEAT PACKET COUNT TO 15
0076 328E4F         STA    SAMPAC
0079 3EFF           MVI    A,0FFH         ;ADDRESS TO BE SENT IN ALL ACK. PACKETS
007B 32B44F         STA    ADDRES
                    ;
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
; THIS MARKS THE START OF THE MAIN BODY OF THE PROGRAM. FROM THIS
; MAIN BODY, ALL OTHER ROUTINES ARE CALLED. THIS PORTION OF THE
; PROGRAM CONTROLS THE FLOW OF PROGRAM OPERATION.
```

```
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                 ;
                 ;
007E 3A8C4F RECON:  LDA   TXFLG    ;SEE IF THERE IS DATA READY FOR TRANSFER
0081 A7             ANA   A        ;SEE IF THERE ARE ANY PACKETS READY FOR XMIT
0082 CAA700         JZ    MLOOP    ;IF NOT, WAIT TO RECEIVE
0085 20             RIM            ;ELSE, SEE IF BOARD IS SELECTED
0086 07             RLC
0087 DC3E02         CC    HPOUT    ;IF SO, OUTPUT CONVERTED DATA PACKET (CC)
008A 212F03         LXI   H,RCV    ;ELSE, PREPARE TO RECEIVE WHILE WAITING
                                   ;TO TRANSFER TO MUX BOARD
008D CDFE02         CALL  CMDOUT
0090 FB     MLOOP3: EI
0091 3200E0         STA   RESET
0094 00             NOP
0095 00             NOP
0096 F3             DI
0097 3A8C4F         LDA   TXFLG    ;HAS TRANSFER OCCURRED
009A A7             ANA   A
009B CAAD00         JZ    MLOOP2   ;IF SO, RETURN TO ORIGINAL LOOP
009E 20             RIM            ;GET CURRENT INTERRUPT STATUS
009F 07             RLC            ;SEE IF BOARD IS BEING SELECTING
00A0 DC3E02         CC    HPOUT    ;IF SO, BEGIN TRANSFER TO MUX BOARD
00A3 FB             EI             ;ELSE ENABLE INTERRUPTS AND CONTINUE WAITING
00A4 C39000         JMP   MLOOP3
                    ;
00A7 212F03 MLOOP:  LXI   H,RCV    ;PREPARE TO TURN-ON RECEIVER
00AA CDFE02         CALL  CMDOUT   ;OUTPUT COMMANDS
00AD FB     MLOOP2: EI             ;ENABLE INTERRUPTS AND WAIT FOR DATA
00AE 3200E0         STA   RESET    ;HIT THE RESET CIRCUIT
00B1 3A0060         LDA   SSTAT    ;GET CURRENT STATUS FROM 8372
00B4 00             NOP
00B5 00             NOP
00B6 C3AD00         JMP   MLOOP2
                    ;
                    ;
00B9 3A9E4F TXSTRT: LDA   CNVBUF   ;GET CONVERT BUFFER FLAG
00BC A7             ANA   A        ;IS THE CONVERTER BUFFER FULL
00BD C2E800         JNZ   TX1      ;IF NOT, CONTINUE
00C0 3A8D4F         LDA   DATAVA   ;SEE IF VALID DATA IS AVAILABLE FOR CONVERSION
00C3 A7             ANA   A
00C4 CAE800         JZ    TX1      ;IF NOT DATA AVAILABLE, BEGIN RETRANSMISSION
00C7 2A904F         LHLD  HPCNVT   ;ELSE PREPARE TO CONVERT DATA PACKET
00CA 3E10           MVI   A,10H
00CC CD5D03         CALL  OFFSET
00CF 22924F         SHLD  HPSAVE
00D2 CD6403         CALL  CNVRT3   ;CONVERT DATA PACKET
00D5 2A904F         LHLD  HPCNVT
00D8 3E13           MVI   A,13H
00DA CD5D03         CALL  OFFSET   ;UPDATE DATA CONVERTER POINTER TO POINT
                                   ;AT NEXT DATA PACKET TO BE CONVERTED
00DD 3E26           MVI   A,26H
00DF BD             CMP   L        ;IS REG. L READY TO BE RESET TO LOCATION 1
00E0 C2E500         JNZ   TXCONT   ;IF NOT CONTINUE
00E3 2E00           MVI   L,00H    ;ELSE RESET TO LOCATION 1
00E5 22904F TXCONT: SHLD  HPCNVT   ;STORE NEW VALUE OF CONVERTER POINTER
00E8 21A74F TX1:    LXI   H,XMIT   ;PREPARE TO TURN-ON TRANSMITTER
```

```
00EB CDFE02     275         CALL    CMDOUT          ;OUTPUT CAMMANDS
00EE FB         276 TXLOOP: EI
00EF 3200E0     277         STA     RESET
00F2 00         278         NOP
00F3 C3EE00     279         JMP     TXLOOP
                280         ;
                281         ;
                282 ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                283 ; THIS ROUTINE CHECKS THE POINTER VALUE IN THE H&L REGISTER
                284 ; PAIR TO INSURE THAT IT IS NOT OUT-OF-RANGE
                285 ; THE OUTPUT BUFFER IS DESIGNED TO HOLD 480 8-BYTE PACKETS IN
                286 ; THE RANGE FROM 4026H TO 4F26H.
                287 ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                288         ;
                289         ;
00F6 7D         290 OVERFL: MOV     A,L             ;MOVE LSB OF POINTER INTO A
00F7 FE26       291         CPI     26H
00F9 C0         292         RNZ
00FA 7C         293         MOV     A,H             ;MOVE MSB OF POINTER INTO A
00FB FE4F       294         CPI     4FH
00FD C0         295         RNZ
00FE 212640     296         LXI     H,TOPOUT        ;IF POINTER IS 4F26H, RESET TO TOP
                297                                 ;OF OUTPUT BUFFER
0101 3EFF       298         MVI     A,0FFH          ;SET CONVERTER BUFFER FULL FLAG (OUTPUT BUF
0103 329E4F     299         STA     CNVBUF
0106 C9         300         RET
                301         ;
                302         ;
                303         ;
                304 ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                305 ; THIS ROUTINE INPUTS A DATA BYTE FROM THE 8273, THIS ROUTINE
                306 ; ALSO CHECKS FOR TRANSMISSIONS ERRORS AS WELL AND THE END-
                307 ; OF-MESSAGE FLAG.
                308 ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                309         ;
                310         ;
0107 3E0E       311 INPDAT: MVI     A,0EH           ;SET INTERRUPT MASK TO OUTPUT
0109 30         312         SIM                     ;TO CRT.
010A 3A0060     313         LDA     SSTAT           ;GET STATUS WORD FROM 8273
010D 32B54F     314         STA     STATUS          ;STORE STATUS WORD
0110 E602       315         ANI     02H             ;IS THERE A RECEIVER INTERRUPT RESULT
0112 CA8001     316         JZ      INBYTE          ;IF NOT, INPUT DATA IS AVAILABLE
0115 3AB54F     317         LDA     STATUS          ;ELSE, READ STATUS BYTE & DETERMINE RESULT
0118 E610       318         ANI     10H             ;IS IT AN IMMEDIATE RESULT
011A CA2101     319         JZ      CONTR           ;IF NOT CONTINUE
011D 3A0160     320         LDA     RESULT          ;ELSE, READ RESULT
0120 C9         321         RET
0121 3A0360     322 CONTR:  LDA     RXIR            ;GET RECEIVER INTERRUPT RESULT
0124 FE03       323         CPI     03H             ;IS THERE A CRC ERROR
0126 CA6D01     324         JZ      DATCRC          ;IF SO, SEE WANT KIND
0129 E60F       325         ANI     0FH             ;IS PACKET RECEIVED COMPLETE AND ERROR FREE
012B 3E00       326         MVI     A,00H           ;RESET DATA INPUT COUNTER
012D 32574F     327         STA     GETID
0130 CA3F01     328         JZ      GOODR           ;IF SO, GOTO GOOD RECEIVE
0133 3EC3       329 BADR:   MVI     A,0C3H          ;NEGATIVE ACKNOWLEDGEMENT BYTE
0135 32BC4F     330         STA     TXBYTE          ;STORE IN BYTE TO BE TRANSMITTED LOACTION
0138 21EB00     331         LXI     H,TX1           ;SET RETURN POINTER TO TRANSMIT NACK
```

```
013B E3          332          XTHL                ;SWITCH WITH STACK
013C C34B01      333          JMP     RSTAT       ;GOTO STATUS LOOP
013F 3EA5        334 GOODR:   MVI     A,0A5H      ;POSITIVE ACKNOWLEDGEMENT
0141 32BC4F      335          STA     TXBYTE
0144 32BD4F      336          STA     DATAVA      ;SET DATA AVAILABLE FLAG
0147 21B900      337          LXI     H,TXSTRT    ;SET RETURN VECTOR TO CONVERT DATA AND TRANS.
014A E3          338          XTHL                ;SWITCH WITH STACK
014B 00          339 RSTAT:   NOP
014C 00          340          NOP
014D 00          341          NOP
014E 00          342          NOP
014F 00          343          NOP
0150 00          344          NOP
0151 3E08        345          MVI     A,08H       ;ENABLE ALL INTERRUPTS
0153 30          346          SIM
0154 3E0D        347          MVI     A,0DH       ;PUT CARRIAGE RETURN INTO CRT BUFFER
0156 32B64F      348          STA     CRTBUF      ;PUT CARRIAGE RETURN IN CRT BUFFER
0159 3A0060      349 RSTATL:  LDA     SSTAT       ;READ STATUS
015C E608        350          ANI     08H         ;ANY RECEIVER INTERRUPTS PENDING
015E C8          351          RZ                  ;IF NO RETURN
015F 3A0060      352          LDA     SSTAT       ;ELSE, READ STATUS AGAIN TO CHECK FOR RXIR
0162 E602        353          ANI     02H         ;IS A RXIR AVAILABLE
0164 CA5901      354          JZ      RSTATL      ;IF NOT, WAIT
0167 3A0360      355          LDA     RXIR        ;ELSE, READ INTERRUPT RESULT BYTE
016A C35901      356          JMP     RSTATL      ;CHECK TO SEE IF ANY MORE RESULTS EXIST
                 357          ;
016D 3AB74F      358 DATCRC:  LDA     GETID       ;SEE IF ANY DATA HAS BEEN INPUT YET
0170 A7          359          ANA     A           ;SEE IF ZERO
0171 C27801      360          JNZ     BADCRC
0174 3E0A        361          MVI     A,0AH       ;ENABLE 7.5 AND 5.5
0176 30          362          SIM
0177 C9          363          RET
0178 3E00        364 BADCRC:  MVI     A,00H
017A 32B74F      365          STA     GETID       ;CLEAR HEADER COUNTER
017D C33301      366          JMP     BADR
                 367          ;
0180 3E0E        368 INBYTE:  MVI     A,0EH       ;SET INTERRUPT MASK TO INPUT SERIAL DATA
0182 30          369          SIM
0183 3AB74F      370          LDA     GETID       ;GET DATA INPUT COUNTER
0186 E603        371          ANI     03H         ;SEE IF DATA, ID, OR ADDRESS IS EXPECTED
0188 C29401      372          JNZ     REALDT      ;IF 2 OR 3, INPUT BYTE IS DATA OR ID
018B 3E02        373          MVI     A,02H
018D 32B74F      374          STA     GETID       ;STORE 2, ADDRESS ALREADY RECEIVED
0190 3A00B0      375          LDA     SDATAI      ;READ ADDRESS TO CLEAR INTERRUPTS
0193 C9          376          RET
0194 FE02        377 REALDT:  CPI     02H         ;IS BYTE DATA OR ID
0196 C2DB01      378          JNZ     GETBYT      ;IF VALUE IS 2, INPUT BYTE IS ID
0199 3E03        379          MVI     A,03H
019B 32B74F      380          STA     GETID       ;STORE 3, ID AND ADDRESS ALREADY RECEIVED
019E 3A00B0      381          LDA     SDATAI      ;READ INPUT BYTE, ID
01A1 47          382          MOV     B,A         ;PUT ID INTO REG. B
01A2 3ABB4F      383          LDA     ID          ;GET PREVIOUS PACKET ID
01A5 B8          384          CMP     B           ;ARE THEY THE SAME
01A6 C2BB01      385          JNZ     NEWPAC      ;IF NOT, THIS PACKET IS NOT A RETRANS.
01A9 218E4F      386 SAMEPC:  LXI     H,SAMPAC    ;PUT LOCATION OF REPEAT PACKET COUNT INTO HL
01AC 35          387          DCR     M           ;DECREMENT CURRENT REPEAT PACKET COUNT
01AD CAB701      388          JZ      RSLOP       ;IF 15 REPEAT HAVE BEEN RECEIVED, RESET BOARD
```

```
01B0 2AA24F     385         LHLD    POINTI          ;ELSE, PACKET IS RETRANS. RESET POINTERS
01B3 22B34F     390         SHLD    CURRENT
01B6 C9         391         RET
01B7 00         392 RSLOP:  NOP                     ;THIS IS A INFINITE LOOP TO RESET BOARD
01B8 C3B701     393         JMP     RSLOP
01BB 78         394 NEWPAC: MOV     A,B             ;PUT NEWLY READ ID BACK INTO A
01BC 32BE4F     395         STA     ID              ;STORE NEW PACKET ID
01BF 2AB34F     396         LHLD    CURRENT         ;SINCE NEW DATA, UPDATE POINTERS
01C2 7D         397         MOV     A,L             ;PUT REG. L INTO A
01C3 FE26       398         CPI     26H             ;HAS INPUT LOCATION 2 BEEN LOADED
01C5 C2CA01     399         JNZ     NEWCON          ;IF NOT, PUT DATA THERE
01C8 2E00       400         MVI     L,00H           ;ELSE, PUT DATA IN LOCATION 1
01CA 22B34F     401 NEWCON: SHLD    CURRENT
01CD 22A24F     402         SHLD    POINTI
01D0 3AAD4F     403         LDA     PACKET          ;GET CURRENT PACKET COUNT
01D3 FED0       404         CPI     0D0H            ;IS PACKET COUNT AT MAXIMUM
01D5 C8         405         RZ                      ;IF SO, RETURN
01D6 3C         406         INR     A               ;ELSE, INCREMENT THE PACKET COUNT
01D7 32AD4F     407         STA     PACKET          ;STORE UPDATED VALUE
01DA C9         408         RET
01DB 3E0A       409 GETBYT: MVI     A,0AH           ;SET INTERRUPT MASK TO OUTPUT TO CRT
01DD 30         410         SIM
01DE 2AB34F     411         LHLD    CURRENT         ;GET CURRENT INPUT POINTER
01E1 3A0080     412         LDA     SDATAI          ;GET INPUT DATA BYTE
01E4 77         413         MOV     M,A             ;SAVE BYTE IN RAM
01E5 32B64F     414         STA     CRTBUF          ;PUT DATA BYTE IN CRT OUTPUT BUFFER
01E8 23         415         INX     H
01E9 22B34F     416         SHLD    CURRENT         ;STORE UPDATED POINTER
01EC C9         417         RET
                418         ;
                419         ;
                420 ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                421 ; THIS ROUTINE OUTPUTS A SINGLE DATA BYTE TO THE 8273 UPON
                422 ; REQUEST, THIS ROUTINE ALSO CHECKS FOR TRANSMISSION ERRORS AND
                423 ; END-OF-MESSAGE INTERRUPTS.
                424 ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                425         ;
                426         ;
                427         ;
01ED 3A0060     428 OUTACK: LDA     SSTAT           ;GET STATUS FROM 8273
01F0 32B54F     429         STA     STATUS          ;STORE CURRENT STATUS
01F3 E601       430         ANI     01H             ;IS THERE AN INTERRUPT RESULT AVAIL.
01F5 CA3202     431         JZ      OUTBYT          ;IF NOT, OUTPUT DATA BYTE
01F8 3AB54F     432         LDA     STATUS          ;GET PREVIOUSLY READ STATUS BYTE
01FB E610       433         ANI     10H             ;IS THERE AN IMMEDIATE RESULT AVAIL.
01FD CA0402     434         JZ      CONT            ;IF NOT CONTINUE ON
0200 3A0160     435         LDA     6001H           ;IF SO, READ RESULT
0203 C9         436         RET
0204 3A0260     437 CONT:   LDA     TXIR            ;READ INTERRUPT RESULT BYTE
0207 FE00       438         CPI     00H             ;IS PACKET COMPLETE AND ERROR FREE
0209 C21602     439         JNZ     BAD             ;IF NOT, GOTO TO BAD
LOC  OBJ        LINE        SOURCE STATEMENT

020C 21BA4F     440         LXI     H,ADDRES        ;ELSE, RESET ACK. BUFFER POINTER
020F 22BD4F     441         SHLD    TXPNT
0212 C31C02     442         JMP     STATLP          ;CHECK AGAIN
```

05/16/95 4,755,872

```
0215 00                     NOP                     ;TURN RECEIVER ON AT THIS POINT
0216 21BA4F          BAD:   LXI     H,ADDRES
0219 22BD4F                 SHLD    TXPNT
                            ;
021C 3A0060          STATLP: LDA    SSTAT           ;GET STATUS BYTE TO CHECK FOR RESULTS
021F E601                   ANI     01H             ;ARE THERE ANY MORE RESULTS AVAILABLE
0221 CA2A02                 JZ      TURNON          ;IF NO RESULTS, RETURN (RZ)
0224 3A0260                 LDA     TXIR            ;READ INTERRUPT RESULT BYTE
0227 C31C02                 JMP     STATLP          ;CHECK FOR MORE RESULT BYTES
022A 217E00          TURNON: LXI    H,RECON         ;LOAD HL WITH RETURN ADDRESS
022D E3                     XTHL                    ;PUT ON TOP OF STACK
022E 3E0E                   MVI     A,0EH           ;SET INTR. MASK TO RECEIVE
0230 30                     SIM
0231 C9                     RET
0232 2ABD4F          OUTBYT: LHLD   TXPNT           ;GET CURRENT ACK. OUTPUT DATA POINTER
0235 7E                     MOV     A,M             ;PUT DATA BYTE INTO A
0236 320070                 STA     SDATAO          ;OUTPUT DATA TO 8273
0239 23                     INX     H
023A 22BD4F                 SHLD    TXPNT           ;STORE UPDATED ACK. OUPUT POINTER
023D C9                     RET
                            ;
                            ;
     ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
     ; THIS ROUTINE OUTPUT 8-BIT PARALLEL DATA TO THE MUX BOARD VIA
     ; THE 8255 I/O CHIP. IC4 PORT B IS USED FOR THIS PURPOSE.
     ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                            ;
                            ;
023E 3E2F            HPOUT: MVI     A,MSTOP         ;PREPARE TO STOP MUX BOARD FROM POLLING
0240 D320                   OUT     PORT5A          ;PULL MUX STOP LINE HIGH
0242 20                     RIM                     ;SEE IF THIS BOARD IS STILL SELECTED
0243 07                     RLC
0244 DA4C02                 JC      HPLOP1          ;IF STILL SELECTED, BEGIN OUTPUTTING (JC)
0247 3EFF                   MVI     A,MUXRUN        ;ELSE, RELEASE MUX BOARD AND RETURN
0249 D320                   OUT     PORT5A          ;RESET STOP LINE LOW
024B C9                     RET
                            ;
024C 3E0C            HPLOP1: MVI    A,00001100B     ;PREPARE TO ENABLE OUTPUTS ON 74LS245
024E D313                   OUT     CPORT4          ;RESET BIT 6, PORT 4C
0250 212640                 LXI     H,TOPOUT        ;PUT OUTPUT DATA POINTER INTO H AND L
0253 7E              HPLOP2: MOV    A,M             ;GET DATA BYTE
0254 D311                   OUT     PORT4B          ;OUTPUT TO MUX BOARD
0256 00                     NOP                     ;ALLOW OUTPUT DATA TO STABLIZE
0257 00                     NOP
0258 3200D0                 STA     MUXWR           ;STROBE DATA INTO MUX BOARD
025B 23                     INX     H               ;INCREMENT OUTPUT POINTER AND CONTINUE
025C 3ABA4F                 LDA     CNVRTP          ;GET ADDRESS OF LAST CONVERTED PACKET
025F BD                     CMP     L               ;HAS ALL CONVERTED DATA BEEN TRANSFERRED
0260 C25302                 JNZ     HPLOP2          ;IF NOT, CONTINUE TRANSFER PROCESS
0263 3ABB4F                 LDA     CNVRTH          ;GET MSB OF ADDRESS
0266 BC                     CMP     H               ;DO THEY MATCH
0267 C25302                 JNZ     HPLOP2          ;IF NOT, CONTINUE TRANSFER
                            ;
026A 3E0D            OUTDON: MVI    A,00001101B     ;DISABLE OUTPUT ON 74LS245
026C D313                   OUT     CPORT4          ;SET BIT 6, PORT 4C
026E 3EFF                   MVI     A,MUXRUN        ;PREPARE TO RELEASE MUX BOARD
```

```
0270 D320               OUT     PORT5A          ;STOP LINE LOW
0272 3E00               MVI     A,00H
0274 329E4F             STA     CNVBUF          ;RESET BUFFER FULL FLAG
0277 328C4F             STA     TXFLG           ;RESET TXFLG, NO DATA READY FOR TRANSFER
027A 212640             LXI     H,TOPOUT        ;RESET CONVERTER POINTER TO TOP-OF-BUFFER
027D 228A4F             SHLD    CNVRTP
0280 C9                 RET
                        ;
                        ;
            ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
            ; THIS IS THE ROUTINE TO OUTPUT THE INPUT DATA TO THE CRT CONSOLE.
            ; DATA TO BE OUTPUT IS PLACED IN THE CRTBUF PRIOR TO THE CALLING
            ; OF THIS ROUTINE.
            ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                        ;
                        ;
0281 3AB64F     OUTCRT: LDA     CRTBUF          ;GET DATA BYTE TO BE OUTPUT
0284 320090             STA     ADATA           ;OUTPUT DATA TO CRT VIA J5 OR J3, (IC1)
0287 FE0D               CPI     0DH             ;WAS OUTPUT BYTE A CR
0289 CA9002             JZ      PUTLF           ;IF SO, PREPARE TO OUTPUT LF
028C 3E1C               MVI     A,1CH           ;SET INTERRUPT MASK TO WAIT FOR INPUT INTR.
028E 30                 SIM
028F C9                 RET
0290 3E1C       PUTLF:  MVI     A,1CH           ;ENABLE BOTH 6.5 ONLY
0292 30                 SIM
0293 3E0A               MVI     A,0AH           ;PUT LF IN CRT BUFFER
0295 32B64F             STA     CRTBUF
0298 C9                 RET
                        ;
            ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
            ; BELOW ARE THE ROUTINES TO SET-UP AND INITIALIZE THE 8250'S
            ; AND THE 8273.
            ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                        ;
                        ;
0299 3E80       I82501: MVI     A,80H           ;SET-UP TO LOAD BAUD DIVISOR
029B 320390             STA     LCR             ;WRITE TO LCR, SET DLAB=1
029E 3E34               MVI     A,34H           ;LSB OF DIVISOR, 8MHZ CRYSTAL (2400)
02A0 320090             STA     BAUDLS          ;4FH FOR 6MHZ CRYSTAL
02A3 3E00               MVI     A,00H           ;MSB OF DIVISOR
02A5 320190             STA     BAUDMS
02A8 3E07               MVI     A,07            ;8-BITS, NO PARITY, 2 STOP BITS
02AA 320390             STA     LCR             ;SET-UP OPERATING CONDITIONS
02AD 3E00               MVI     A,00H
02AF 320590             STA     ASTAT           ;CLEAR LINE STATUS REGISTER
02B2 3E02               MVI     A,02H           ;ENABLE TX BUFFER EMPTY INTERRUPT
02B4 320190             STA     DISINR          ;INTERRUPT ENABLE REGISTER
02B7 3E0F               MVI     A,0FH           ;ACTIVATE MODEM CONTROL LINES
02B9 320490             STA     LCR+1
02BC C9                 RET
            ;
            ;
02BD 212103     I8273:  LXI     H,OPMODES
02C0 CDFE02             CALL    CMDOUT
02C3 212403             LXI     H,SMODES
02C6 CDFE02             CALL    CMDOUT
```

```
02C9 212703     555         LXI     H,DTAXS
02CC CDFE02     556         CALL    CMDOUT
02CF 212A03     557         LXI     H,BITS
02D2 CDFE02     558         CALL    CMDOUT
02D5 212F03     559         LXI     H,RCV
02D8 CDFE02     560         CALL    CMDOUT
02DB C9         561         RET
                562 ;
                563 ;
02DC 3E80       564 I82502: MVI     A,80H           ;SET-UP TO LOAD BAUD DIVISOR
02DE 320380     565         STA     8003H           ;WRITE TO LCR, SET DLAB=1
02E1 3E68       566         MVI     A,68H           ;LSB OF DIVISOR, 8MHZ CRYSTAL
02E3 320080     567         STA     8000H           ;4FH FOR 6MHZ CRYSTAL
02E6 3E00       568         MVI     A,00H           ;MSB OF DIVISOR
02E8 320180     569         STA     8001H
02EB 3E07       570         MVI     A,07            ;8-BITS, NO PARITY, 2 STOP BITS
02ED 320380     571         STA     8003H           ;SET-UP OPERATING CONDITIONS
02F0 3E00       572         MVI     A,00H
02F2 320180     573         STA     8001H           ;CLEAR LINE STATUS REGISTER
02F5 320580     574         STA     8005H           ;DISABLE INTERRUPTS
02F8 3E0F       575         MVI     A,0FH
02FA 320480     576         STA     8004H
02FD C9         577         RET
                578 ;
02FE 0E30       579 CMDOUT: MVI     C,30H
0300 46         580         MOV     B,M
0301 23         581         INX     H
0302 3A0060     582 CMD1:   LDA     SSTAT
0305 07         583         RLC
0306 DA0203     584         JC      CMD1
0309 7E         585         MOV     A,M
030A 320060     586         STA     SCMDRG
030D 78         587 CMD2:   MOV     A,B
030E A7         588         ANA     A
030F C8         589         RZ
0310 23         590         INX     H
0311 05         591         DCR     B
0312 3A0060     592 CMD3:   LDA     SSTAT
0315 E620       593         ANI     20H
0317 C21203     594         JNZ     CMD3
031A 7E         595         MOV     A,M
031B 320160     596         STA     SPRMRG
031E C30D03     597         JMP     CMD2
                598 ;
                599 ;
0321 01         600 OPMODES:        DB      01,91H,00000011B        ;NON-BUFFERED MODE
0322 91
0323 03
0324 01         601 SMODES:         DB      01,0A0H,00000003
0325 A0
0326 00
0327 01         602 DTAXS:          DB      01,97H,00000001B
0328 97
0329 01
032A 01         603 BITS:           DB      01,0A4H,00000000B
032B A4
```

```
032C 00
032D 00          DR:          DB      00,0C5H
032E C5
032F 02          RCV:         DB      02,0C0H,15H,00H         ;RECEIVE 19 BYTES
0330 C0
0331 15
0332 00
                 ;                                            ;PLUS ADDRESS AND ID
                 ;
                 ;
0333 3E02        IXMIT:  MVI     A,02H             ;TWO PARAMETERS IN COMMAND
0335 32A74F              STA     XMIT              ;STORE IN RAM
0338 3EC3                MVI     A,0C8H            ;GENERAL TRANSMIT COMMAND
033A 32A64F              STA     XMIT+1
033D 3E03                MVI     A,03H             ;LSB OF PACKET LENGTH
033F 32A94F              STA     XMIT+2
0342 3E00                MVI     A,00H             ;MSB OF PACKET LENGTH
0344 32AA4F              STA     XMIT+3
0347 C9                  RET
                         ;
                         ;
                 ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                 ; THIS ROUTINE INITIALIZES BOTH 8255 CHIPS.
                 ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                         ;
                         ;
0348 3E90        I8255:  MVI     A,10010000B       ;CONTROL WORD, MODE 0, A=INPUT
                                                   ;B AND C=OUTPUT
034A D313                OUT     CPORT4
034C 3E82                MVI     A,10000010B       ;CONTROL WORD, MODE 0, A=OUPUT
                                                   ;B AND C INPUT
034E D323                OUT     CPORT5
0350 3E1F                MVI     A,MRESET          ;RESET MUX BOARD
0352 D320                OUT     PORT5A            ;ZERO OUTPUT PORT 5A, THIS ALSO RESETS MUX
0354 3EFF                MVI     A,0FFH            ;DISABLE OUTPUTS AND SET DIRECTION OF
                                                   ;IC13, 74LS245.
0356 D312                OUT     PORT4C
0358 3EFF                MVI     A,MUXRUN          ;RELEASE MUX FROM ACTIVE RESET
035A D320                OUT     PORT5A
035C C9                  RET
                         ;
                         ;
                 ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                 ; THIS ROUTINE ADDS TO THE H AND L REGISTERS THE VALUE IN A.
                 ; THE NEW OFFSET VALUE IS RETURNED IN H AND L.
                 ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                         ;
                         ;
035D 85          OFFSET: ADD     L                 ;ADD THE VALUE IN REG. A TO REG. L
035E 6F                  MOV     L,A               ;REPLACE REG. L WITH NEW VALUE
035F 3E00                MVI     A,00H
0361 8C                  ADC     H                 ;ADD CARRY (IF ANY) TO REG. H
0362 67                  MOV     H,A               ;REPLACE H WITH NEW VALUE
0363 C9                  RET
                         ;
                         ;
```

```
          ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
          ; THIS ROUTINE CONVERTS A 3-DIGIT NUMBER (ASCII) INTO A 10-BIT
          ; BINARY NUMBER.
          ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                          ;
                          ;
0364 7E        CNVRT3: MOV     A,M             ;GET SEVENTH DIGIT
0365 D630              SUI     30H             ;CONVERT
0367 6F                MOV     L,A
0368 2600              MVI     H,00H
036A 22964F            SHLD    BYTE34
                       ;
036D 2A924F            LHLD    HPSAVE
0370 2B                DCX     H
0371 7E                MOV     A,M             ;GET SIXTH DIGIT
0372 D630              SUI     30H
0374 21000C            LXI     H,LT10
0377 85                ADD     L
0378 6F                MOV     L,A
0379 5E                MOV     E,M
037A 1600              MVI     D,00H
037C 2A964F            LHLD    BYTE34
037F CDD504            CALL    WORDAD
0382 22964F            SHLD    BYTE34
                       ;
0385 2A924F            LHLD    HPSAVE
0388 2B                DCX     H
0389 2B                DCX     H
038A 7E                MOV     A,M             ;GET FIFTH DIGIT
038B 2B                DCX     H
038C 22924F            SHLD    HPSAVE
038F D630              SUI     30H
0391 87                ADD     A
0392 21000B            LXI     H,LT100
0395 85                ADD     L
0396 6F                MOV     L,A
0397 5E                MOV     E,M
0398 23                INX     H
0399 56                MOV     D,M
039A 2A964F            LHLD    BYTE34
039D CDD504            CALL    WORDAD
03A0 22964F            SHLD    BYTE34
                       ;
                       ;
          ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
          ; THIS ROUTINE CONVERTS A 4-DIGIT NUMBER (ASCII) INTO A 14-BIT
          ; BINARY VALUE.
          ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                       ;
                       ;
03A3 2A924F    CNVRT4: LHLD    HPSAVE          ;GET CURRENT CONVERT DATA POINTER
03A6 7E                MOV     A,M             ;GET FOURTH DIGIT, LSB
03A7 D630              SUI     30H             ;CONVERT ASCII TO HEX
03A9 6F                MOV     L,A             ;PUT IN REG. L
03AA 2600              MVI     H,00H           ;ZERO THE H REG.
03AC 22944F            SHLD    BYTE12          ;SAVE IN BYTEE 1 AND 2 LOCATION
```

```
                    ;
03AF 2A924F         LHLD    HPSAVE      ;GET CONVERTER POINTER
03B2 2B             DCX     H           ;POINT AT THIRD DIGIT
03B3 7E             MOV     A,M         ;GET DIGIT
03B4 D630           SUI     30H         ;CONVERT TO HEX
03B6 21000C         LXI     H,LT10      ;PUT LOOK-UP TABLE BASE ADDRESS IN HL
03B9 85             ADD     L           ;INCREMENT BASE TO APPROPRIATE MULTIPLIER
03BA 6F             MOV     L,A
03BB 5E             MOV     E,M         ;GET THE MULTIPLIER
03BC 1600           MVI     D,00H
03BE 2A944F         LHLD    BYTE12      ;GET CURRENT VALUE OF BYTEES 1 AND 2
03C1 CDD504         CALL    WORDAD      ;ADD THE CURRENT VALUE TO THE PRODUCT
03C4 22944F         SHLD    BYTE12      ;STORE THE NEW VALUE FOR BYTEES 1 AND 2
                    ;
03C7 2A924F         LHLD    HPSAVE
03CA 2B             DCX     H
03CB 2B             DCX     H
03CC 7E             MOV     A,M         ;GET SECOND DIGIT
03CD D630           SUI     30H         ;CONVERT
03CF 87             ADD     A
03D0 21000B         LXI     H,LT100     ;GET BASE ADDRESS
03D3 85             ADD     L           ;OFFSET THE ADDRESS
03D4 6F             MOV     L,A
03D5 5E             MOV     E,M         ;GET MULTIPLIER
03D6 23             INX     H
03D7 56             MOV     D,M
03D8 2A944F         LHLD    BYTE12      ;GET BYTEES 1&2
03DB CDD504         CALL    WORDAD      ;ADD THE PRODUCT TO THE CURRENT VALUE
03DE 22944F         SHLD    BYTE12      ;STORE NEW VALUE
                    ;
03E1 2A924F         LHLD    HPSAVE
03E4 2B             DCX     H
03E5 2B             DCX     H
03E6 2B             DCX     H
03E7 7E             MOV     A,M         ;GET FIRST DIGIT
03E8 2B             DCX     H
03E9 22924F         SHLD    HPSAVE
03EC D630           SUI     30H         ;CONVERT
03EE 87             ADD     A
03EF 21000A         LXI     H,LT1000    ;GET BASE ADDRESS
03F2 85             ADD     L           ;OFFSET BASE
03F3 6F             MOV     L,A
03F4 5E             MOV     E,M         ;GET MULTIPLIER
03F5 23             INX     H
03F6 56             MOV     D,M
03F7 2A944F         LHLD    BYTE12      ;GET CURRENT VALUE
03FA CDD504         CALL    WORDAD      ;ADD THE VALUES
03FD 3EC0           MVI     A,0C0H      ;INSURE THE FIRST TWO BITS OF MSB ARE SET
03FF B4             ORA     H
0400 67             MOV     H,A
0401 22944F         SHLD    BYTE12      ;STORE FINAL VALUE OF BYTEES 1 AND 2
                    ;
                    ;
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
; THIS ROUTINE CONVERTS A THREE DIGIT AREA CODE INTO A 2-BIT
; BINARY CODE. THIS ROUTINE ALSO COMBINES THIS VALUE WITH THE
```

```
            ; EXISTING VALUE OF BYTEES 1 AND 2.
            ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                    ;
                    ;
0404 2A924F CNVRTA: LHLD    HPSAVE
0407 7E             MOV     A,M             ;GET THIRD AREA CODE DIGIT
0408 D630           SUI     30H             ;CONVERT TO HEX
040A 5F             MOV     E,A             ;PUT VALUE INTO REG. E
                    ;
040B 2A924F         LHLD    HPSAVE
040E 2B             DCX     H
040F 7E             MOV     A,M
0410 D630           SUI     30H             ;CONVERT
0412 07             RLC
0413 07             RLC
0414 07             RLC
0415 07             RLC
0416 B3             ORA     E               ;COMBINE THIS VALUE WITH E
0417 5F             MOV     E,A             ;REPLACE REG. E WITH NEW VALUE
                    ;
0418 2A924F         LHLD    HPSAVE
041B 2B             DCX     H
041C 2B             DCX     H
041D 7E             MOV     A,M             ;GET FIRST AREA CODE DIGIT
041E 2B             DCX     H
041F 22924F         SHLD    HPSAVE
0422 D630           SUI     30H             ;CONVERT
0424 67             MOV     H,A             ;PUT INTO REG. H
0425 3EF0           MVI     A,AREA          ;PUT MSB BASE OF AREA CODE LOOK-UP TABLE IN A
0427 B4             ORA     H               ;OFFSET REG. H
0428 67             MOV     H,A             ;H&L NOW HAVE ADDRESS OF 2-BIT AREA CODE
0429 6B             MOV     L,E             ;PUT LSB CURRENTLY IN REG. E, INTO L
042A 7E             MOV     A,M             ;GET 2-BIT AREA CODE
                    ;
042B 2A944F         LHLD    BYTE12          ;GET CURRENT VALUE OF BYTEES 1 AND 2
042E A4             ANA     H               ;COMBINE AREA CODE AND 14-BIT BINARY NUMBER
042F 67             MOV     H,A             ;PUT NEW VALUE INTO REGISTER H
0430 22944F         SHLD    BYTE12          ;STORE FINAL VALUE
                    ;
                    ;
            ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
            ; THIS ROUTINE TAKES FOUR ACSII DIGITS, CONVERTS THEM INTO BINARY
            ; AND COMBINES THEM.
            ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                    ;
                    ;
0433 2A924F CNVRTD: LHLD    HPSAVE
0436 7E             MOV     A,M             ;GET FIRST DATA DIGIT
0437 D630           SUI     30H             ;CONVERT
0439 47             MOV     B,A             ;PUT INTO B
                    ;
043A 2B             DCX     H
043B 7E             MOV     A,M             ;GET SECOND DATA DIGIT
043C D630           SUI     30H
043E 07             RLC                     ;PUT 2ND BCD DIGIT INTO MSN
043F 07             RLC
```

```
0440 07          RLC
0441 07          RLC
0442 B0          ORA     B             ;COMBINE REGISTERS A AND B
0443 6F          MOV     L,A
0444 2600        MVI     H,00H
0446 229A4F      SHLD    BYTE78        ;SAVE WORD #3, BYTES 7 AND 8
                 ;
0449 2A924F      LHLD    HPSAVE
044C 2B          DCX     H
044D 2B          DCX     H
044E 7E          MOV     A,M           ;GET THIRD DATA DIGIT
044F D630        SUI     30H
0451 47          MOV     B,A
                 ;
0452 2B          DCX     H
0453 7E          MOV     A,M           ;GET FOURTH DATA DIGIT
0454 D630        SUI     30H
0456 07          RLC
0457 07          RLC
0458 07          RLC
0459 07          RLC
045A B0          ORA     B
045B 6F          MOV     L,A
045C 2600        MVI     H,00H
045E 22984F      SHLD    BYTE56        ;STORE BYTES 5 AND 6, WORD #2
                 ;
                 ;
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
; THIS ROUTINE TRANSFERS THE CONVERTED DATA PACKET TO THE OUTPUT
; BUFFER.
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                 ;
                 ;
0461 2ABA4F      LHLD    CNVRTP        ;GET OUTPUT BUFFER POINTER
0464 EB          XCHG                  ;PUT INTO REGITERS D&E
                 ;
0465 2A944F      LHLD    BYTE12        ;GET FIRST TWO BYTES
0468 7D          MOV     A,L
0469 12          STAX    D
046A 13          INX     D
046B 7C          MOV     A,H
046C 12          STAX    D
046D 13          INX     D
                 ;
046E 2A964F      LHLD    BYTE34        ;GET SECOND WORD
0471 7D          MOV     A,L
0472 12          STAX    D
0473 13          INX     D
0474 7C          MOV     A,H
0475 12          STAX    D
0476 13          INX     D
                 ;
0477 2A984F      LHLD    BYTE56        ;GET THIRD WORD
047A 7D          MOV     A,L
047B 12          STAX    D
047C 13          INX     D
```

```
047D 7C           MOV   A,H
047E 12           STAX  D
047F 13           INX   D
                  ;
0480 2A9A4F       LHLD  BYTE78       ;SET FOURTH WORD
0483 7D           MOV   A,L
0484 12           STAX  D
0485 13           INX   D
0486 7C           MOV   A,H
0487 12           STAX  D
0488 13           INX   D
                  ;
0489 EB           XCHG
048A CDF600       CALL  OVERFL       ;SEE IF BUFFER POINTER IS STILL IN RANGE
048D 228A4F       SHLD  CNVRTP       ;SAVE NEW OUTPUT BUFFER POINTER
                  ;
0490 21AD4F       LXI   H,PACKET     ;PUT THE ADDRESS OF PACKET INTO HL
0493 35           DCR   M            ;DECREMENT THE CURRENT PACKET COUNT
0494 218C4F       LXI   H,TXFLG      ;PUT ADDRESS OF TXFLG IN HL
0497 36FF         MVI   M,0FFH       ;SET DATA AVAILABLE FOR TRANSFER FLAG
0499 3E00         MVI   A,00H
049B 32BD4F       STA   DATAVA       ;RESET DATA AVAILABLE FLAG
049E C9           RET
                  ;
                  ;
                  ;
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
; THIS ROUTINE MULTIPLIES A 16-BIT VALUE BY A 8-BIT VALUE.
; THE NUMBER TO BE MULTIPLIED SHOULD BE STORED IN MEMORY LOC. VALUE.
; REGISTERS H&L SHOULD ALSO CONTAIN THE VALUE TO BE MULTIPLIED.
; REGISTER A SHOULD CONTAIN THE MULTIPLIER.
; THE RESULT (PRODUCT) WILL BE RETURNED IN THE H AND L REGISTERS.
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                  ;
                  ;
049F 07     MULTI: RLC               ;SEE IF ODD OR EVEN MULTIPLIER
04A0 DAB604       JC    ODD          ;IF CARRY, MULTIPLIER IS ODD
                  ;
04A3 0F     EVEN: RRC                ;READJUST MULTIPLIER
04A4 57           MOV   D,A          ;PUT IT IN D
04A5 7D           MOV   A,L          ;PUT VALUE TO BE MULTIPLIED INTO A
04A6 15     ELP1: DCR   D            ;DECREMENT MULTIPLY COUNTER
04A7 CAD404       JZ    DONE
04AA 17           RAL
04AB D2A604       JNC   ELP1
04AE 6F           MOV   L,A
04AF 7C           MOV   A,H
04B0 17           RAL
04B1 67           MOV   H,A
04B2 7D           MOV   A,L
04B3 C3A604       JMP   ELP1
                  ;
04B6 3F     ODD:  CMC                ;CLEAR CARRY
04B7 1F           RAR                ;ADJUST MULTIPLIER
04B8 57           MOV   D,A
04B9 7D           MOV   A,L
```

```
04BA 15        OLP1:   DCR     D
04BB CACA04            JZ      NOWADD
04BE 17                RAL
04BF D2BA04            JNC     OLP1
04C2 6F                MOV     L,A
04C3 7C                MOV     A,H
04C4 17                RAL
04C5 67                MOV     H,A
04C6 7D                MOV     A,L
04C7 C3BA04            JMP     OLP1
                       ;
04CA EB        NOWADD: XCHG
04CB 2A9C4F            LHLD    VALUE
04CE 7D                MOV     A,L
04CF 83                ADD     E
04D0 6F                MOV     L,A
04D1 7C                MOV     A,H
04D2 8A                ADC     D
04D3 67                MOV     H,A
                       ;
04D4 C9        DONE:   RET
                       ;
                       ;
               ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
               ; THIS ROUTINE ADDS TWO 16-BIT WORDS.
               ; ONE WORD SHOULD BE PLACED IN THE D&E REG. AND THE OTHER IN THE
               ; H&L REG.
               ; THE RESULT (SUM) IS RETURNED IN THE H&L REGISTERS.
               ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                       ;
                       ;
04D5 7B        WORDAD: MOV     A,E
04D6 85                ADD     L
04D7 6F                MOV     L,A
04D8 7A                MOV     A,D
04D9 8C                ADC     H
04DA 67                MOV     H,A
04DB C9                RET
                       ;
                       ;
                       ;
                       END

PUBLIC SYMBOLS


EXTERNAL SYMBOLS


USER SYMBOLS
ACKFLG A 4FA6   ADATA  A 9000   ADDRES A 4F6A   AREA   A 00F0   ASTAT  A 9005   BAD    A 0216   BADCRC A 0178
BADR   A 0133   BAUDLS A 9000   BAUDMS A 9001   BEGIN  A 0040   BITS   A 032A   BUFFER A 4000   BYTE12 A 4F94
BYTE34 A 4F96   BYTE56 A 4F98   BYTE78 A 4F9A   CMD1   A 0302   CMD2   A 030D   CMD3   A 0312   CMDOUT A 02FE
CNTRL  A 4FAC   CNVBUF A 4F9E   CNVRT3 A 0364   CNVRT4 A 03A3   CNVRTA A 0404   CNVRTD A 0433   CNVRTH A 4F63
CNVRTF A 4F5A   CONT   A 02D4   CONTR  A 0121   CPGRT4 A 0013   CPORTS A 0023   CRTBUF A 4F36   CURREN A 4F93
DATAVA A 4F8D   DATCRC A 016D   DISINF A 9001   DONE   A 04D4   DR     A 0320   DTAXS  A 0327   ELF1   A 04A8
EVEN   A 04A3   GETBYT A 0106   GETID  A 4F67   GOODR  A 013F   HPCNVT A 4F90   HPLOP1 A 024C   HPLOP2 A 0253
HPGLT  A 023E   HPSAVE A 4F72   IB2501 A 0299   IB2502 A 02DC   IB255  A 0348   IB273  A 02ED   ID     A 4FB6
```

```
INBYTE A 0180   INCOME A 4FA4   INPORT A 0107   LIMIT  A 0333   LCR    A 9003   LT10   A 0C00   LT100  A 0B00
LT1000 A 0A03   MLOOP  A 00A7   MLOOP2 A 00AB   MLOOP3 A 0090   MRESET A 001F   MSTOP  A 002F   MULTI  A 049F
MUXRUN A 00FF   MUXWR  A D000   NEWCON A 01CA   NEWPAC A 0183   NOWADD A 04CA   ODD    A 04B6   OFFSET A 035D
OLP1   A 04B4   OPMODE A 0321   OUTACK A 01ED   OUTBYT A 0232   OUTCRT A 0281   OUTDON A 02BA   OVERFL A 00F3
PACKET A 4FAC   POINT1 A 4FAC   POINTO A 4F40   PORT4A A 0010   PORT4B A 0011   PORT4C A 0012   PORT54 A 0020
PUTLP  A 0290   RAM    A 4000   RCV    A 032F   REALDT A 0194   RECON  A 007E   RESET  A E000   RESULT A 8001
RSLOP  A 01B7   RSTAT  A 014B   RSTATL A 0159   RXIR   A 6003   SAMEPC A 01A9   SAMPAC A 4F6E   SCNDRB A 6000
SDATAI A B000   SDATAO A 7000   SMODES A 0324   SPRMRG A 6001   SSTAT  A 6000   START  A 0051   STATLP A 021C
STATUS A 4F65   TL1    A 0047   TOPOUT A 40Ze   TURNON A 0224   TX1    A 00EE   TXBYTE A 4FBC   TXCONT A 00E5
TXFLG  A 4FBC   TXIR   A 6002   TXLOOP A 00E3   TXPNT  A 4FBE   TXSTAT A 4FA5   TXSTRT A 0069   VALUE  A 4F9C
WORDAD A 0405   XMIT   A 4FA7

ASSEMBLY COMPLETE,  NO ERRORS
```

What is claimed is:

1. A method for implementing telephone-based purchase requests by a subscriber, said subscriber having a telephone unit served by a telephone company central office, said telephone company central office using a computer which, in response to a telephone call from the subscriber, provides a calling line data message which includes an origination telephone number for the calling subscriber and destination telephone number data entered by the calling subscriber via his telephone unit to indicate said purchase request, comprising the steps of:

electronically receiving a calling line data message from the telephone company central office;

applying first information representing the origination telephone number of the subscriber directly to a system controller at an operator station, said system controller having access to authorization information editable by a billing system concerning the eligibility of the subscriber for said purchase request;

determining from said first information and said authorization information whether the subscriber making the request is eligible to make the purchase; and

if said determining step indicates that the subscriber is eligible for said purchase, then executing the request and indicating the transaction to a billing system.

2. The method of claim **1** wherein said receiving step is done in real time at said telephone company central office and the method further includes communicating only a portion of said received calling line data message to said operator station.

3. The method of claim **2** including buffering said portion of said calling line data message at said telephone company central office.

4. The method of claim **3** including receiving said calling line data message asynchronously and communicating said portion of said calling line data message synchronously to said operator station.

5. A method of implementing telephone-based pay per view requests by subscribers to view pay per view events, each of said subscribers having an addressable access terminal unit, each subscriber having a telephone unit, said telephone units being served by telephone company central offices, each of said telephone company central offices using a computer which, in response to a telephone call from a calling subscriber, provides a calling line data message which includes an origination telephone number for the calling subscriber and destination telephone number data entered by the calling subscriber via his telephone unit to indicate a pay per view request, comprising the steps of:

electronically receiving a plurality of calling line data messages from respective calling subscribers at plural telephone company offices;

electronically transmitting at least the origination telephone number portion and the destination telephone number data portion of each of the calling line data messages to a headend station;

electronically receiving said origination telephone number portion and said destination telephone number data portion of each of said calling line data messages at said headend station and applying said telephone number portions directly to a system controller;

locating, using said system controller, stored data indicating whether said calling subscribers are eligible to view the requested pay per view events, at least a portion of said stored data having been responsive to input from a billing system, said locating step occurring at said headend station and employing said telephone number portions; and

addressing and updating data stored in the calling subscriber' access terminal units if said stored data indicates that said calling subscribers are eligible to view the requested pay per view events.

6. The method of claim **5** wherein the step of electronically receiving a plurality of calling line data messages at each of plural telephone company central offices occurs in real time and the method further includes buffering said portions of the calling line data messages at each of the telephone company central offices.

7. The method of claim **6** including providing communication units located at respective telephone central offices to receive said calling line data messages, strip data therefrom to provide compressed data, said compressed data including said portions of calling line data messages, providing corresponding communication controllers located at said headend station, and transmitting said compressed data to said corresponding communication controllers.

8. The method of claim **7** including buffering said portions of the calling line data messages at said communication controllers and multiplexing said portions of the buffered calling line data messages to apply them to said system controller.

9. The method of claim **7**, further comprising a data conversion step occurring at said communication controllers.

10. The method of claim **8** wherein said multiplexing step includes sequentially addressing each of said com-

munication controllers and permitting each addressed controller to communicate said buffered data for a time which depends on the time required for a communication controller to communicate all of its buffered data ready for output.

11. The method of claim **10** wherein when each of said communication controllers is addressed, if it has buffered data ready to be communicated, an interruption of said sequentially addressing occurs.

12. The method of claim **11** wherein said multiplexing step includes sequentially addressing said controllers with a multiplexer and communicating buffered data from said controllers to said multiplexer, the method further including buffering data at said multiplexer.

13. The method of claim **12** wherein after said multiplexer addresses a communication controller, the addressed communication controller interrupts said sequential addressing and verifies that the address outputted by said multiplexer after said sequential addressing has been interrupted is the address of said addressed communication controller, and if so, thereafter communicates buffered data to said multiplexer.

14. The method of claim **11** including refraining from said interrupting said step of sequentially addressing if the addressed controller determines that data is to be inputted thereto.

15. The method of claim **12** wherein said step of sequentially addressing is interrupted if inadequate buffering capability exists at said multiplexer.

16. The method of claim **9** wherein the origination telephone number portion of a calling line data message includes a plurality of ASCII digits and wherein said data conversion step includes converting said ASCII digits into a binary number.

17. The method of claim **16** wherein two of the ASCII digits are converted into a binary number by:

subtracting 30 hexadecimal from the ASCII digit in the one's place to produce a one's place binary value;

subtracting 30 hexadecimal from the ASCII digit in the ten's place to produce a ten's place binary value;

combining the ten's place binary value with a ten's place look-up table base address to produce a ten's place look-up table address;

addressing a look-up table with the ten's place look-up table address to produce a weighted ten's place binary value; and

adding the weighted ten's place binary value to the one's place binary value to produce the binary number equivalent to the two digit ASCII number.

18. The method of claim **16** wherein the origination telephone number portion of a calling line data message includes a three digit ASCII number representing the area code of a calling subscriber and wherein the three digit ASCII area code number is converted into a two bit binary value by:

subtracting 30 hexadecimal from the first ASCII digit to produce a first binary value;

subtracting 30 hexadecimal from the second ASCII digit to produce a second binary value;

rotating the second binary value left four places to produce a rotated second binary value;

adding the first binary value to the rotated second binary value and storing the sum in a first register location;

subtracting 30 hexadecimal from the third ASCII digit to produce a third binary value;

adding a look-up table base address to the third binary value and storing the sum in a second register location;

combining the values stored in the first and second register locations to produce a register pair; and

addressing a memory with the register pair to locate the two bit binary value corresponding to the ASCII area code value.

19. A method for executing a telephone-based pay per view ("PPV") request to view an event in a system having a headend station and numerous subscribers remotely located from said headend station, said subscribers having telephone units served by plural telephone company central offices and having one-way addressable access terminal units, comprising the steps of:

receiving calling line data messages from Automatic Number Identification ("ANI") computers coupled to the plural telephone company central offices, each of said calling line data messages including an origination telephone number for a respective calling subscriber making a PPV request and a destination telephone number entered by the calling subscriber via his telephone unit to indicate a PPV request, said receiving step occurring at each of said telephone company central offices in real time;

stripping unnecessary data received from said ANI computers and buffering the resulting data at units associated with respective central offices; then

separately communicating said resulting data from each of said units to corresponding communication controllers located at the headend station;

converting the format of data received by said communication controllers and temporarily storing converted data thereat;

communicating said converted data from said communication controllers directly to a system controller at the headend station at a high transfer rate, said system controller having stored data therein for said subscribers, said stored data having been responsive to input from a billing system;

locating said stored data for said calling subscribers by using said origination telephone numbers and determining whether said stored data indicates that said calling subscribers can view said PPV event; and

communicating address codes and authorization codes to said addressable access terminal units.

20. The method of claim **19** further including communicating a transaction to said billing system after said last-named communicating step, and wherein said resulting data includes both origination and destination telephone numbers.

21. A system for executing a telephone-based per pay per view (PPV) request, the system having a headend station and numerous subscribers remotely located from the headend station, said subscribers having telephone units served by a telephone company central office and having one-way addressable access terminal units, comprising:

a receiving circuit coupled to an Automatic Number Identification (ANI) computer at the telephone company central office for receiving message data representing a request from a calling subscriber, said data including the calling subscriber's telephone number and data representing an event as to which a transaction is requested by the calling subscriber;

a communication link between said receiving circuit and the headend station;

a system controller located at the headend station for electronically mapping the telephone number portion of said message data into subscriber data stored in said system controller, said subscriber data including eligibility data indicating whether the calling subscriber is eligible to receive the event;

a billing system coupled to said system controller, said billing system being able to alter said eligibility data;

a coupling circuit coupling said message data directly to said system controller, said system controller determining from said eligibility data and said message data whether the calling subscriber is eligible to view said event and if so, then authorizing said addressable access terminal units to be addressed; and

an encoding circuit responsively coupled to said system controller for communicating with the access terminal units associated with said calling subscriber.

22. The system according to claim 21 wherein said receiving circuit includes means for stripping unnecessary data from said message data and a buffer coupled to said means for stripping for temporarily storing data to be transmitted over said communication link.

23. The system of claim 22 including means for synchronously communicating data over said communication link.

24. The system according to claim 21 wherein said headend station includes means for buffering data received via said communication link.

25. The system according to claim 21 wherein said coupling circuit includes a communication controller coupled to said communication link.

26. The system according to claim 25 wherein said communication controller includes means for buffering data received via said communication link and further includes means for converting into binary form the data representative of the telephone number of the subscriber and for coupling said binary form data to said system controller.

27. A system for executing telephone-based pay per view (PPV) requests to view an event, the system having a headend station and numerous cable subscribers remotely located from said headend station, said subscribers having telephone units served by plural telephone company central offices, each subscriber having at least one one-way addressable access terminal unit, comprising:

plural circuits for receiving data representing calling subscriber requests, including the calling subscriber telephone numbers, from Automatic Number Indentification (ANI) computers assocated with the telephone company central offices;

plural communication links each arranged for coupling a respective one of said circuits for receiving to said headend station;

a system controller at said headend station;

a coupling circuit at said headend station for coupling said calling subscriber telephone numbers to said system controller; said system controller being operable to map said subscriber telephone numbers into subscriber data, said subscriber data including eligibility data indicating whether the calling subscribers are eligible to receive the requested event;

a billing system coupled to said system controller, said billing system being able to alter said eligibility data; said system controller determining from said eligibility data whether the calling subscribers are eligible to view the requested event; and

an encoding circuit responsively coupled to said system controller for communicating authorization codes to the access terminal units of the calling subscribers.

28. The system according to claim 27 wherein each of said circuits for receiving includes a buffer for storing data.

29. The system according to claim 28 wherein each said circuit for receiving further includes means for stripping unneeded information from the data received from said ANI computer, said means for stripping being coupled to said buffer.

30. The system according to claim 27 wherein said coupling circuit includes means for buffering data received at said headend station via said communication link.

31. The system according to claim 27 wherein said coupling circuit includes plural communication controllers each coupled via a respective communication link to a respective circuit for receiving, and coupled also to said system controller.

32. The system according to claim 31 wherein each of said communication controllers includes means for buffering data received via its corresponding communication link.

33. The system according to claim 32 wherein each communication controller includes means for converting data received via said communication link into binary data.

34. The system according to claim 33, wherein said coupling circuit further includes a multiplexer coupled to each of said plural communication controllers and to said system controller.

35. The system according to claim 34 wherein said multiplexer includes means for sequentially addressing said communication controllers, and wherein each communication controller includes means responsive to a preselected address generated by said multiplexer, means for interrupting said sequential addressing by said multiplexer, each of said communication controllers being responsive to said interrupting for transferring temporarily stored data to said multiplexer.

36. The circuit according to claim 35 wherein each of said communication controllers includes a respective logic means for determining whether data received via said communication link is good data and for acknowledging to a corresponding circuit for receiving the receipt of good data, for converting the received data into binary data, and for loading said converted binary data into said buffer to await transmission to said multiplexer.

37. The system according to claim 36 wherein said multiplexer includes a counting circuit having an output, said system including a bus for coupling said counting circuit output to each of said communication controllers, each of said communication controllers including means for providing a predetermined count and including a comparison circuit for producing an equality signal when said counting circuit output is equal to said predetermined count, said logic means being responsive to said equality signal to enable a stop signal, said stop signal being coupled to said counting circuit and said counting circuit being inhibited when said stop signal is enabled.

38. The system according to claim 37 wherein said logic means is operative for checking the counting circuit output after said counting circuit stops, and for transferring data from said communication controller to said multiplexer if the counting circuit output after said counting circuit has stopped corresponds to the predetermined count within said communication controller.

39. The system according to claim 36 wherein said logic means is operative to cause the transfer of all converted data stored in said buffer in said communication controller to said multiplexer after said multiplexer has been interrupted from further sequential addressing.

40. The system according to claim 35 wherein said multiplexer includes a temporary storage device and a logic circuit coupled to said temporary storage device, said storage device being coupled to an input of said multiplexer, said input being coupled to each of said communication controllers, said logic circuit being operative for temporarily storing data received at said input in said storage device.

41. The system according to claim 40 wherein said multiplexer includes means associated with said storage device for indicating when said storage device has reached a predetermined level regarding its storage capacity, said means for indicating being coupled to said means for sequentially addressing communication controllers, said means for sequentially addressing being responive to said means for indicating to interrupt the sequential addressing.

42. The system according to claim 31 wherein said system controller includes an input buffer and an output buffer, said input buffer being coupled to receive a set of data words representing said subscriber requests, said system controller processing data taken from said input buffer and determining said address codes and said authorization codes corresponding to the subscriber requests, and providing said codes to said output buffer.

43. The system according to claim 42 wherein said system controller includes first and second input buffers and first and second output buffers, said system controller controlling said input and output buffers for receiving data from said communication controllers at one of said input buffers while processing data contained in other of said buffers; said output buffers communicating with said encoding circuit, one of said output buffers being operable for receiving data processed by said system controller while the other of said buffers is communicating data to said encoding circuit.

44. A system for executing telephone-based pay per view (PPV) requests from subscribers to view a PPV event, the system having a headend station and numerous subscribers remotely located from the headend station, said subscribers having telephone units served by a telephone company central office and having one-way addressable access terminal units comprising:

a plurality of communication units each located at a respective telephone company central office and each communicating with a respective ANI computer for receiving calling line message data therefrom including the telephone number of each subscriber calling said telephone company central office with a request to view said PPV event and a destination telephone number which indicates said PPV event;

a plurality of communication controllers located at said cable headend station, each corresponding to a respective communication unit;

a plurality of first communication links for coupling each of said communication units to its corresponding communication controller;

a second communication link coupled to all of said communication controllers for receiving data therefrom, including the telephone numbers of said subscribers who have called to request said event;

a system controller directly coupled to said second communication link for receiving data therefrom and for mapping said telephone numbers into respective blocks of stored data each of which includes, for the respective subscriber, the subscriber's access terminal unit address and eligibility data indicative of whether the calling subscriber may view said PPV event, said blocks of data being stored in said system controller;

an encoding circuit responsively coupled to said system controller for communicating data to the access terminal units of those subscribers whose said eligibility data indicates that they are entitled to view said PPV event;

a billing system coupled to said system controller for updating said eligibility data;

each of said communication units including a logic means responsive to the receipt of data from the corresponding ANI computer for stripping therefrom unnecessary data, each of said communication units including a storage device, said logic means being operable to store data remaining after said stripping in said storage device;

each of said communication controllers including logic means and a storage device, said logic means being operative for causing data received at said communication controller via the corresponding first communication link to be stored temporarily in said storage device and for converting the format of data into binary form.

45. The system according to said claim 44 wherein said second communication link comprises a multiplexer which includes means for sequentially addressing each of said communication controllers and means for interrupting said sequentially addressing means; wherein the logic means in each of said communication controllers determines that said communication controller is being addressed by said multiplexer and, in response, activates said means for interrupting said sequential addressing until after the transfer of temporarily stored data from said communication controller to said multiplexer.

46. The system according to claim 44 further including means for communicating to said billing system data representative of said PPV requests which have been mapped by said system controller thereby to adjust data for the subscriber to reflect their PPV requests which have been processed.

47. The method of claim 1 wherein said applying step comprises mapping the subscribers origination telephone number into a block of data concerning the subscriber, said block indicating whether the subscriber is eligible to make the requested purchase, at least a portion of said block of data corresponding to said information received from said billing system; said comparing step comprising determining the contents of a portion of said block of data.

48. The method of claim 47 further comprising buffering said calling line data message at said telephone company central office; stripping data from said calling line data message; and transmitting the remaining data after said stripping step to said operator station; said

mapping step occurring at said cable operator station.

49. The method of claim 1 wherein said authorization information is located in said system controller.

50. The method of claim 1 wherein said authorization information comprises a flag which is editable by said billing system.

51. The method of claim 5 wherein said stored data is located in said system controller.

52. The method of claim 51 wherein said stored data comprises a flag and wherein said billing system is operable to edit said flag from time to time.

53. The method of claim 9 wherein said communication units strip unnecessary data from said calling line data messages to provide compressed calling line data; and wherein said communication controllers reorganize said compressed calling line data and convert the format thereof into one or more binary formats.

54. The method of claim 53 wherein each of said communication controllers:

converts the origination telephone numbers which it receives by reading a look-up table for a first portion of each respective origination telephone number to provide a first binary number;

converts a second portion of the origination telephone number into a second binary number; and

combines said first and second binary numbers into a third binary number which it communicates to said system controller.

55. The method of claim 19 wherein said stored data inlcues a flag which is able to be updated from time to time by said billing system.

56. The method of claim 21 wherein said eligibility data comprises a flag.

57. A method for implementing telephone-based pay per view ("PPV") requests by subscribers to view a PPV event, each said subscriber having a telephone unit served by a telephone company central office and having an addressable access terminal unit, said telephone company central office using apparatus which, in response to a telephone call from the subscriber, provides a corresponding calling line data message which includes the origination telephone number for calling subscriber and the destination telephone number data entered by the calling subscriber via the subscriber's telephone unit to indicate the PPV request, comprising the steps of:

electronically receiving calling line data messages from the telephone company central office in a first data format;

stripping unnecessary data from said each calling line data message to provide a plurality of compressed data measages each of which includes the origination telephone number and said destination number of a calling subscriber;

temporarily storing said plurality of said compressed data messages;

transmitting said plurality of compressed data messages via a communication link to a headend office;

receiving said plurality of compressed data messages at a communication controller at said headend station;

converting the format of the portions of said compressed data messages which include the origination telephone numbers received by said communication controllers into binary format, including finding a first binary number in a look-up table for a first portion of an origination telephone number, converting a second portion of said origination telephone number into a second binary number, and converting a third portion of said origination telephone number into a binary format; said communication controller also converting said destination telephone number into a binary format; and

communicating said binary numbers directly to a system controller, said system controller locating, from each said origination telephone number, a data block for the corresponding calling subscriber, said data block including a flag which indicates whether said calling subscriber may receive said PPV event; said data block flags being editable by a billing system; said system controller updating the addressable access terminal unit of a said calling subscriber if the corresponding said flag indicates that said calling subscriber is eligible to view said PPV event.

58. The method according to claim 57 wherein said destination telephone numbers are converted into binary coded decimal and wherein said system controller uses said first and second binary numbers to look up further information to find said data block.

59. The method according to claim 57 wherein said communication controller consults a look-up table to determine a first number of binary bits indicating the area code of said origination telephone number, consults a look up table to determine a second number of binary bits indicating a second portion of said telephone origination number, and combines said first and second binary numbers.

60. The method of claim 57 wherein said data blocks are stored in said system controller.

61. The method of claim 1 wherein said applying step includes receiving information at first and second input buffers alternately, said system controller performing said comparing step on information which has been stored in one of said input buffers while information is being received at the other said input buffer, said system controller loading processed data into first and second output buffers alternately, the method further comprising communicating said processed data from said output buffers to an encoding circuit, one of said output buffers communicating with said encoding circuit while the other said output buffer receives said processed data from system controller.

62. The system of claim 27 wherein said subscriber data is stored in said system controller.

63. The method of claim 1 wherein said purchase requests are for pay per view video events, wherein said subscriber has an addressable access terminal unit and wherein said executing step comprises addressing said access terminal units to permit the pay per view event to be viewed.

* * * * *

Patent Application Publication

CONVERSANT® 1 VOICE SYSTEM: ARCHITECTURE AND APPLICATIONS

AT&T TECHNICAL JOURNAL

Robert J. Perdue and Eugene L. Rissanen

Robert J. Perdue *is a supervisor in the Conversant Systems Development Department at AT&T Bell Laboratories in Columbus, Ohio. He is responsible for developing advanced speech and signal processing systems for network and commercial customers. He received both M.S.E.E. and B.S.E.E. degrees from Massachusetts Institute of Technology in 1973.*

Eugene L. Rissanen *is a member of the technical staff in the Conversant Systems Development Department at Bell Laboratories in Columbus. He is developing advanced speech capabilities for the Conversant® 1 voice system. He joined AT&T in 1968. He received a B.S.E.E. degree from Michigan Technological University in 1968, an M.S.E.E. degree from Columbia University in 1970, and a Ph.D. in electrical engineering from Ohio State University in 1976.*

A flexible and cost-effective system for introducing speech technology into the marketplace is described. The system answers telephone calls from lines and trunks and provides verbal prompts and information to the caller. The caller can request specific information and direct the transaction by using either touch-tone or voice input. Requested information is obtained either from a small data base on the system disk or from an external source. Other system functions include recognition of isolated words and connected digit strings, recording and encoding of phrases and announcements for playback during a transaction, and call transfer and origination. A special interpreted language for specifying the transaction dialog allows diverse applications of the system to be easily written and modified.

A New Venture

There exists at AT&T a tremendous knowledge base in the broad areas of speech and signal processing, telecommunications, language understanding, artificial intelligence, and systems development. Advancing technology has recently made it possible to put this knowledge to work in salable speech products and services. In 1985, AT&T formed a new venture, Conversant Systems, chartered to research the marketplace and develop speech systems to satisfy customer needs. The venture consists of colocated people from AT&T Technology Systems and AT&T Bell Laboratories, who together have expertise in marketing, development, and manufacturing.

Our market research has provided a broad perspective on available products, customer preferences, and areas where new markets could be created. For example, a significant market exists for automating telephone attendant activities in information access systems.[1,2] Desired functions of these attendant automation products include speech and touch-tone recognition, speech encoding and storage, playback of coded speech, speaker verification, and telephone call origination and handling.

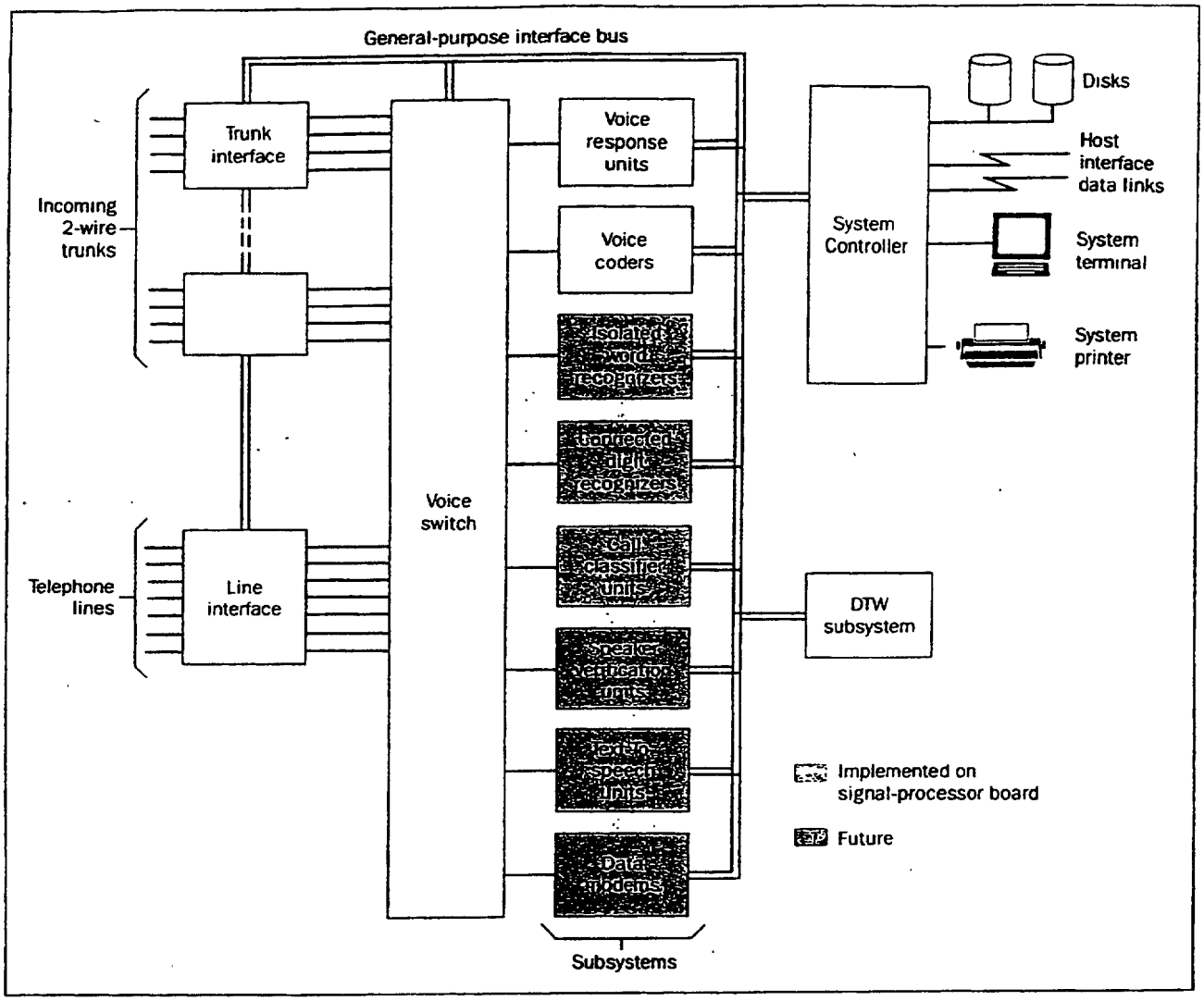


Figure 1. General architecture of the Conversant 1 voice system.

On the basis of these market studies, the Conversant® 1 voice system was designed. The system was made flexible enough to cover a wide spectrum of call-handling applications in a cost-effective manner. A large number of calls can be handled concurrently. A centralized switch allows various subsystems, such as speech recognizers and voice response units, to be shared among calls. To allow customization for particular applications, the transaction dialog is written in a special language that is interpreted in real time. Speech processing algorithms, subsystems, and other hardware already available have been relied upon heavily.[3-13] Where necessary new algorithms and subsystems have been developed.

System Architecture and Operation

An underlying goal of the system architecture is that it accommodate a large variety of applications with a minimum of adaptation effort. This goal is reflected in both its hardware configuration, as described here, and its generic and application-specific software, as described later in this article.

In its most general configuration, shown in Figure 1, the system consists of a set of telephone trunk and line interface units, a set of specialized speech subsystems, a switch to connect these subsystems to the trunks and lines, and a system controller to coordinate the whole operation. The speech subsystems, which include voice response units, voice coders, and speech recognition units, can be readily shared among calls, and several types of subsystems can be connected sequentially to a single call. The type and number of subsystems and interface units will depend on the particular application. The interface units, switch, and subsystems are connected to a general-purpose interface bus (the IEEE 488 GPIB) and will sometimes be referred to as GPIB devices. The system controller (SC) uses the bus to communicate with the GPIB devices. The SC also supports optional data links to one or more host machines.

At the highest level, the operation of the system is controlled by application-dependent "transaction scripts" residing in the SC. These scripts contain commands which specify the dialog and flow of events during a call. The script language, which will be described later, includes commands to answer incoming calls, speak various phrases, gather touch-tone or spoken digits, obtain data items from an internal or external data base, and transfer calls.

At a lower level, each script command is decomposed into a set of tasks when the command is executed. For example, a command to speak a particular phrase requires the following tasks:

- Parsing the phrase into words or subphrases
- Determining if the voice response unit (VRU) serving the call has the needed subphrases in its cache
- Downloading subphrases not already in the VRU cache
- Sending a message to the VRU specifying the subphrases to be played
- Awaiting a completion message from the VRU.

While awaiting the VRU completion message, the script interpreter program will execute script commands for other calls in progress. Hence, many calls can be handled simultaneously and independently in a multitasking manner.

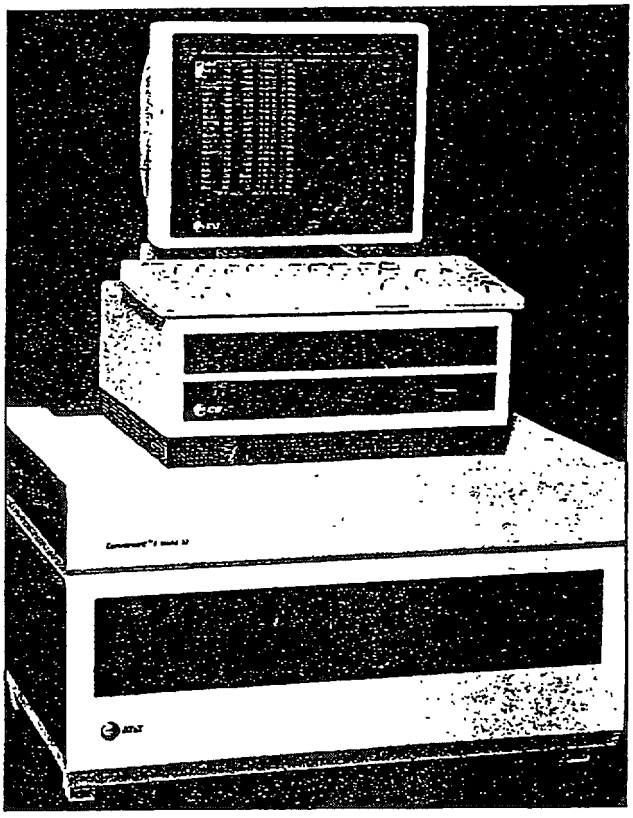


Figure 2. The Conversant 1 voice system, model 32.

Depending on the script commands, different subsystems on the voice switch can be connected to the call, as needed. The script can also obtain application-dependent data via a data interface process.

Variations of the general configuration of Figure 1 have been used. For example, in many voice response applications, a VRU must be dedicated to each call for the

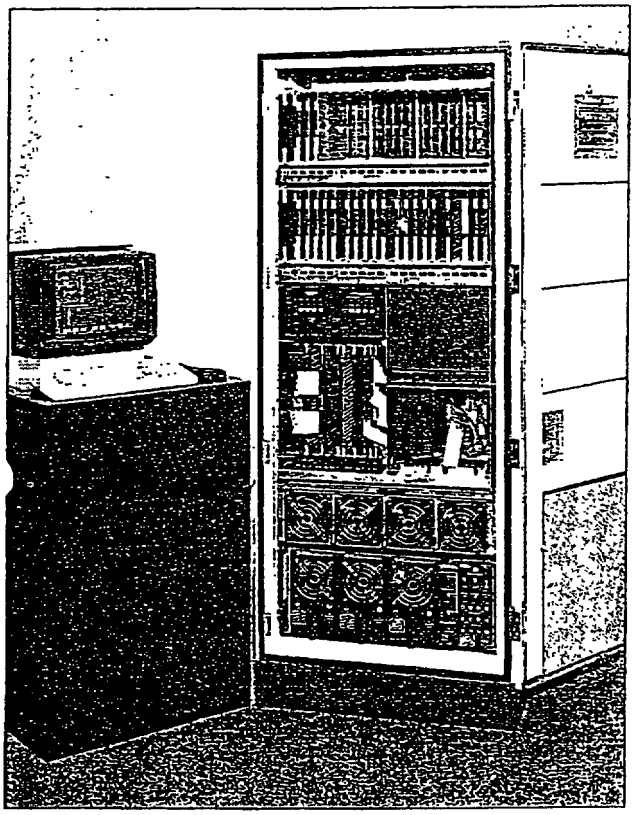


Figure 3. The Conversant 1 voice system, model 80.

entire duration of the call. Hence, one of our standard configurations has each trunk interface unit wired to a dedicated VRU. The voice switch is used to connect additional subsystems to the call.

Physical System Design. There are currently two models of the Conversant 1 voice system, model 32 and model 80 (Figures 2 and 3). The main difference between them is the SC and the physical housing. The call-handling capabilities of both are functionally equivalent.

The model 32 uses an AT&T PC6300 Plus computer as its SC while the model 80 SC is based on a commercial single-board computer. With redundant power supplies, alarm systems, and automatic reboot capability, the model 80 is suited for larger applications that demand an extra margin of system availability.

Both models use AT&T Fastech® backplane technology for the GPIB devices. The model 80 packs its GPIB devices and SC on the shelves of a tall floor-standing cabinet, whereas the model 32 consists of the PC6300 Plus and one or more single-shelf tabletop cabinets for the GPIB devices.

The System Controller. For simplicity, only the model 32 system controller is described here. The PC6300 Plus was chosen because of its availability, UNIX environment, GPIB compatibility, and low cost. The PC6300 Plus is based on the Intel 80286 processor and comes equipped with 1 megabyte of memory, a 20-Mbyte hard disk, a 1.2-Mbyte floppy disk, a GPIB interface board, and a 4800-baud asynchronous data port.[13]

Depending on the specific application, optional features that will be used include:

- An additional megabyte of memory with future expansion to 7 Mbyte
- A faster and larger (40, 67, or 135 Mbyte) hard disk for the speech phrases and any internal application data bases
- A streaming tape drive for program backups
- An additional GPIB interface board to access subsystems
- Four-port asynchronous communication boards for host data links
- Synchronous protocol communication boards for host data links
- A printer.

GPIB Device Descriptions. A short functional description of several GPIB devices is given in this section. Each device consists generally of a single circuit board.

Trunk interface circuits. Each trunk interface circuit (TIC) can handle up to four 2-wire incoming trunks from a

central office. Currently, ground start and direct inward dialing reverse battery signaling systems are accommodated.

Voice response units. Each voice response unit (VRU) can handle up to four simultaneous calls. The VRU decodes and plays either multipulse linear prediction coded (MPLPC) speech or sub-band coded speech, as described under "Speech Synthesis Capability." An on-board cache can hold up to 400 seconds of MPLPC speech. Phrases not in cache can be downloaded from the SC disk in real time. The VRU also detects touch-tone signals.

Line interface units. Each line interface unit (LIU) can initiate calls or receive calls on up to six ordinary dial pulse or touch-tone telephone lines. Calls are initiated or answered via commands from the SC.

Voice coders. A voice coder (VC) provides real-time encoding of the caller's speech for storage and later playback through a VRU. This allows features such as entering announcements and voice messaging to be implemented.

Signal processor. The signal processor (SP) is a general-purpose programmable subsystem containing an MC68000 computer, a 2-Mbyte memory, and up to four DSP32 signal processor chips. Each SP can handle up to two simultaneous calls. Programs for the SP enable it to perform speaker-independent speech recognition (both connected digits and isolated words), speaker verification, and originating call classification, as described later in this article.

Dynamic time warper subsystem. Speech recognition is accomplished by matching (or comparing) the unknown spoken word to stored templates of known words. In order to provide a timely response to the speaker, the SP speech recognizer by itself is limited to about 200 to 250 template comparisons. The dynamic time warper (DTW) subsystem can be used to extend the number of template matches possible in real time to about 4000.

The DTW subsystem consists of a controller board and eight boards for doing 32 dynamic time warps and template matches in parallel. The results of the comparison are returned to the SP speech recognizer that requested the job. A single DTW subsystem is shared among all speech recognizers.

System Controller Software

Except for the transaction scripts and optional data-base-access modules, the SC software is generic, and consists of the UNIX™ operating system, several permanent processes, and some special commands for maintenance and diagnostics, system administration, and system usage statistics. As depicted in Figure 4, the permanent UNIX processes include:

- A transaction state machine to run transactions as specified in the transaction script
- A GPIB interrupt handler to field device requests for service
- A GPIB output process to send commands to the devices
- A data interface process to access local and/or host data bases
- A call data handler to generate and store statistics on processed calls
- An error tracker to collect and report various hardware and software errors
- A maintenance process to run on-demand and automatic diagnostics on the subsystems.

An application is built upon the generic software in three basic steps:

1. Define the dialog and write the transaction script.
2. Define any data request messages and write the application layer subroutines needed to access data bases.
3. Record and encode the speech for any phrases to be spoken to the caller.

The first two steps are discussed in the remainder of this section and phrase encoding is covered in the section, "Speech Synthesis Capability."

Transaction Scripts. The transaction state machine (TSM) controls the transactions in progress by executing commands of a transaction script written for a particular application. TSM can handle many calls, i.e., run many transaction scripts concurrently. Since the transaction

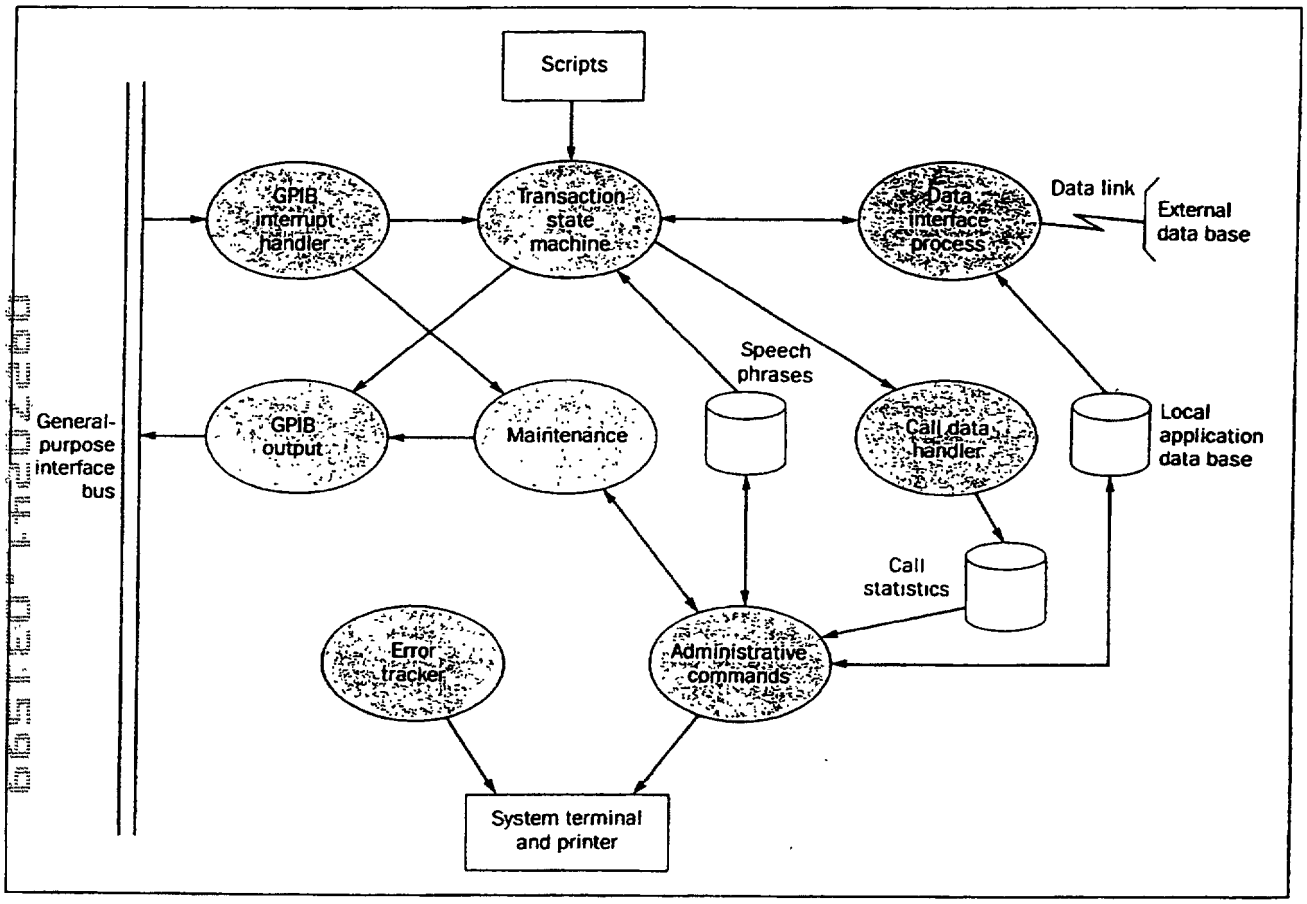


Figure 4. System controller software for the Conversant 1 system.

scripts may be different, several independent applications can be implemented on a single system. The script to be run on a particular call is normally determined by either the trunk the call uses or the direct inward dialing digits forwarded to our system by the central office.

An annotated example of a simple transaction script for a call routing application is shown in Panel 1. The panel represents a sample script for airline reservations. The script is essentially a set of instructions that tell the system how to carry out transactions. The column at the right of the panel contains the script writer's comments on the instructions.

In this example, it is assumed that the system is

Panel 1: Sample Script

A sample script for an airline reservation application is shown below. The script is essentially a set of instructions that tell the system how to carry out transactions. The right-hand column contains the script writer's comments on instructions.

```
    /*****************************************************************/
    /*                        Sample Script                          */
    /*  Call Routing by VOICE or TOUCH-TONE Entry of 1, 2, 3 or 4    */
    /*****************************************************************/

#define IN           0                    /* location for input        */
#define EXT          2                    /* location for extension    */
#define VOICE_OR_TT 16                    /* for getdig, voice or TT   */
tfile("list.callrt")                      /* call routing phrases      */


PLAY_MENU:
    talk("thanks for calling" "sil250")   /* phrase & 250 msec silence  */
    talk("please speak or press")         /* phrase & no silence        */
    talk("1 for reserv" "sil250")         /* phrase & pause             */
    talk("2 for flight sched" "sil250")   /* ditto                      */
    talk("3 for freight info" "sil250")   /* ditto                      */
    talk("or 4 for assist")

GET_INPUT:
    addeq('s')                            /* attach speech recognizer   */
    tttime(5, 5)                          /* set timouts                */
    getdig(VOICE_OR_TT, ch.IN, 1)         /* get 1 digit, into ch.IN    */
    dropeq('s')                           /* release speech recognizer  */
    jmp(r.0 < im.0, no_good)              /* if no input, go to no_good */
    case(ch.IN, im.'1', got_1, DIAL_OUT)  /* if "1", handle it & go on  */
    case(ch.IN, im.'2', got_2, DIAL_OUT)  /* if "2", handle it & go on  */
    case(ch.IN, im.'3', got_3, DIAL_OUT)  /* if "3", handle it & go on  */
    /* got input, but not 1, 2 or 3; treat the same as no input        */

 no_good:
    talk("hold for assistance")           /* no good input              */
    load(ch.EXT, im.'0174')               /* extension for assistance   */
    goto DIAL_OUT

 got_1:
    talk("hold for reserv")               /* confirm, got a 1           */
    load(ch.EXT, im.'0171')               /* extension for reservations */
    rts()                                 /* return from subroutine     */

 got_2:
    talk("hold for flight sched")         /* confirm, got a 2           */
    load(ch.EXT, im.'0172')               /* extension for schedules    */
    rts()

 got_3:
    talk("hold for freight info")         /* confirm, got a 3           */
    load(ch.EXT, im.'0173')               /* extension for freight      */
    rts()

DIAL_OUT:
    liu('f')                              /* flash the line             */
    liu('d', ch.EXT)                      /* dial the extension         */
    quit()
```

connected by an LIU to an automatic call director (ACD) and can transfer calls to specific ACD attendant pools. The caller is prompted via the "talk" command to enter: 1 for reservations, 2 for flight schedules, 3 for freight information, or 4 for assistance. The "addeq" command causes a speech recognizer to be connected to the call. The "getdig" command asks for one touch-tone digit or one spoken word to be collected. Depending on the received digit, the call is transferred via the "liu" commands to the appropriate attendant pool. If 1, 2, or 3 is not detected within the 5 seconds specified, the call is transferred to the general assistance attendant.

Data Base Access. Many transactions require access to a changing data base. The "dbase" script command sends a data request message to the data interface process (DIP) of Figure 4. Since the contents and structure of such data bases are application-dependent, the script writer specifies the structure of the messages sent to and returned by the DIP. The DIP contains several application-dependent subroutines that obtain the requested data from either a local or a host data base. The DIP passes the data back to TSM, which in turn makes it available to the script.

Small data bases that are relatively stable can be kept locally on the system disk. Larger dynamic data bases are kept by a host machine and are accessed in real time by our system over a data link.

Measurements. A facility is available for the script writer to count any events important to the application, such as calls handled successfully, data base requests, and user errors. These counters are essential for determining system usage and performance.

Speech Synthesis Capability

The phrases spoken by the VRU during a transaction are concatenations of one or more recorded phrase files. In order to conserve disk space, encoding techniques are used to compress the recorded speech. Two encoding algorithms being used are described briefly below and more thoroughly in References 6 and 7.

Multi-Pulse Linear Predictive Coding. Multi-pulse linear predictive coding (MPLPC) of speech is implemented by first breaking the speech signal into 10-ms segments and determining the best filter that fits the spectrum of the segment. A sequence of pulses is then fed into the filter to produce a synthesized speech signal at the filter output. The positions and amplitudes of the pulses are adjusted to minimize the difference (the error) between the real speech and the synthesized speech. Speech can then be reproduced from the filter coefficients and pulse positions and amplitudes saved for each segment. With this technique, quality speech can be encoded at rates as low as 9.6 kb/s.

Sub-Band Coding. In sub-band coding (SBC), the speech signal is divided into four frequency bands, and each band is encoded in adaptive pulse-code modulation format. The basic idea is that the bit rate needed to encode each band can be tailored to the ear's sensitivity to quantization noise in that frequency range. For bit rates of 16 kb/s and above, SBC produces quality speech that is compatible with other AT&T voice services.

Encoding Procedures. Conversant Systems offers a service for speech phrase recording and encoding. Customers may send phrase lists to be professionally recorded, edited, and encoded. Alternatively, the Conversant 1 voice system can be used to encode and store spoken phrases. The system is called with a phone number that invokes a transaction script written to handle speech recording. The actual encoding of speech, in either MPLPC or SBC, is performed by the voice coder subsystem, which is connected to the call via a script command. The recorded speech files can be audibly reviewed and visually edited via a video terminal attached to an SC port. Edit commands currently available replay the speech and reduce leading and trailing silence.

Speech Synthesis. The encoded speech files can be played out by the VRU. The DSP20 digital signal processor chip on the VRU is programmed to convert the encoded speech back to 64-kb/s pulse-code modulation format. The digital speech signal is then converted to its final analog form.

Speech Recognition Capability

The speech recognition capability is a major attraction of the system. A limited vocabulary of spoken isolated words and connected digit strings can be recognized. Speech recognition consists of first detecting and determining the endpoint of an unknown utterance, and then classifying it as a particular word in the vocabulary. For connected digit strings, a third step involves error correction. Some details of the algorithm are given here.

When requested to recognize N words, the speech recognizer digitizes received speech and generates an energy contour. An endpointing algorithm identifies the intervals containing words based on a top-down analysis of the energy contour.

Each endpointed interval (unknown word) is classified by comparing it to models (or templates) of all the words in the vocabulary being used. The comparison involves a dynamic time warping procedure to account for variations in speaking rate.[3] For speaker-independent word recognition, each word must be represented by a set of templates to cover various voices and dialects. The unknown word is classified the same as the template set it most closely matches. Words that do not closely match any template set are rejected. The templates used in the system have been generated from hundreds of speech samples collected over the telephone network from diverse regions of the country.

Isolated Word Recognition. The speech recognizer subsystem can perform about 200 to 250 template matches in real time. For speaker-independent recognition, this corresponds to a vocabulary size of about 10 words. Larger vocabularies and connected digit recognition require the assistance of the DTW subsystem.

Excellent recognition accuracy has been obtained on a large and diverse telephone speech data base consisting of several control words. A large fraction of the words not correctly recognized are normally rejected. Some specific accuracy numbers are given in "Applications," below.

Connected Digit Recognition. Recognizing connected words is inherently more difficult than isolated words for two reasons: first, the endpointer is more likely to miss spoken words and interpret noise or word fragments as words; second, any misrecognized word in the string causes the entire string to be wrong. To compensate for this added degree of difficulty, the digit strings recognized by the system contain redundant digits to permit error correction. Strings of 3, 6, and 9 digits (including redundant digits) have been recognized in various applications.

Without error correction, a digit recognition accuracy, over the telephone network, of under 90 percent is obtained on our large data base. Although consistent with other similar experiments,[14] this digit accuracy is much too low for recognizing digit strings. With error correction, the effective per-digit accuracy jumps to over 99 percent. About half the strings not correctly recognized were rejected and half were misclassified. To obtain this accuracy boost, 4 redundant digits are appended to each 5-digit string, and certain resulting 9-digit strings that prove difficult to recognize are not used.

In practice, after a redundant 9-digit string is recognized at the start of a call, the decoded digits are used to label the raw digits. This allows speaker-dependent templates to be made and used for the remainder of the call. Repeating this on the second spoken digit string and so on provides a bootstrapping mechanism, causing recognition accuracy to improve considerably as the call proceeds.

Call Generation Capability

Many business systems have banks of attendants placing calls to customers. The attendants dial the phone number, listen for the call progress tones (ring, busy, etc.) and talk to the customer when the call completes. Sizable savings in attendant time can be achieved by automating the call placement. The savings would result from automatic dialing and autonomous handling of calls that do not complete. Only calls that do complete are transferred to an attendant.

To meet this need, the system is designed to place outgoing calls and transfer those calls that successfully

Table I. Financial Information Transaction Dialog

Caller	System
Dial 800 number	Answer call. "Hello, Fidelity Automated Quotation Service, please enter the nine-digit ID code."
"494327365"	"Initials are JQP, correct?"
"Yes."	"At 10:08 the Dow was at 1864.21, down 5.73. Stock watch list?"
"No."	"Stock quotations?"
"Yes."	"All quotes are delayed 15 minutes. Stock ID?"
"541364672"	"XON is at 60 1/4, down 1/4, volume 29,200. Next stock ID?"
"No."	"Option quotations?"
"Yes."	"All quotes are delayed 15 minutes. Stock ID?"
"697753147"	"NSM last sale was at 11 7/8. First month code?"
"795"	"Strike price code?"
"158"	"NSM August 15 calls are at 1/2. Second month code?"
"No."	"Next stock ID?"
"No."	"Thank you for using the Fidelity Automated Quote Service. Goodbye."

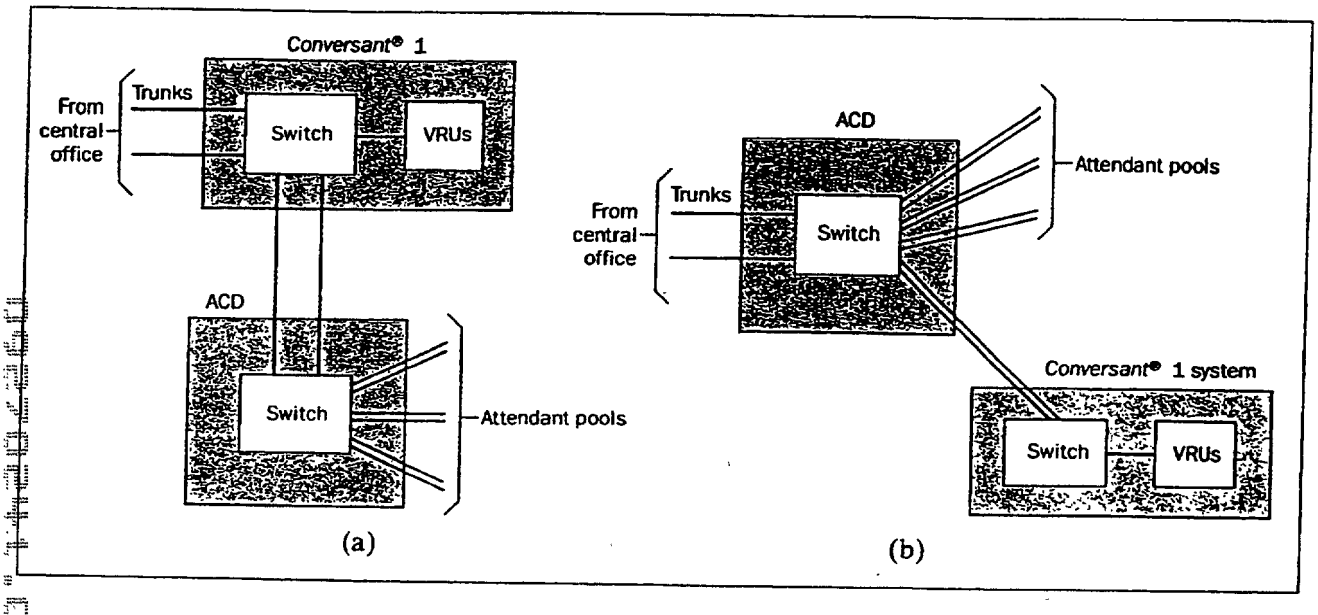


Figure 5. Interface between an automatic call director and a Conversant 1 system. (a) Voice system in front of ACD. (b) Voice system behind ACD.

complete to an attendant. This is accomplished by commanding the TIC (or LIU) to generate a call to a specified number and connecting a call classifier to the call after end of dialing. The call classifier is an SP subsystem programmed to classify the call, i.e., determine its fate, and report back to the SC. The program uses call progress tones and voice detection to classify the call in a manner similar to that currently used by the No. 2 Service Evaluation System.[15] Possible call classifications include:

- Complete—the call has been answered and voice detected.
- Announcement—the call has been answered and a network announcement detected. This can be distinguished from the "complete" classification by the special information tones (SIT) that precede announcements.
- Didn't answer—the called party's phone rang N times with no answer.
- Busy—the called party is off-hook.
- Reorder—the call encountered a congested network.
- High and dry—the call could not be properly handled by the network.

On some trunks, answer supervision is available from the central office. The TIC reports detected answer supervision directly to the SC. In these cases, the call classifier is used to distinguish types of unsuccessful attempts.

Applications

Although the capabilities and operation of the Conversant 1 system are well documented, close customer contact is considered essential in developing applications to solve customer problems. Such contact allows us to understand customer needs and to assist in developing application scripts, generating speech files, etc. Important

applications are also being developed by value-added resellers. Several Conversant 1 system applications described in this section demonstrate its versatility.

Financial Information. In its trial application, the system was installed on the premises of Fidelity Brokerage Services, Inc., in Boston. It provided callers with various stock market information, such as the Dow Jones industrial stock market average and prices and volumes of requested stocks and stock options. The stock information was retrieved by the script in real time, via a data link, from a Fidelity host computer, which in turn was fed by a quote source from the major stock exchanges.

The 500 or so Fidelity customers who participated in the trial were each given a 9-digit user identification number, a catalog of 9-digit numbers for the most active 6000 stocks, a list of 3-digit month and price codes for stock options, and the 800 number of the system. In addition, customers could select up to five stocks they regularly watch. Records of user identification number and stock watch lists were kept in the host computer. The transaction works as shown in Table I. The flow of the transaction is controlled by the caller's "yes" or "no" response to questions posed by the system.

About 70 percent of the customers seemed to prefer touch-tone input over voice. The yes/no accuracy was about 97 percent. Nearly 12 percent of the time, the 9-digit strings were misspoken, i.e., the caller said a wrong digit or skipped a digit. When correctly spoken, only about 3 percent of the strings were misrecognized, another 6 percent were rejected (the caller was asked to repeat the string), and the remaining 91 percent were correctly recognized.

Call Screening and Routing. In this application, the caller is prompted for a digit and the call is routed according to the received digit, as described in the example in Panel 1. An extension of this idea is also planned, where the received digit is used to specify a particular announcement to be played. The caller is then reprompted for a second digit for routing to an attendant or an announcement, and so on.

Two basic configurations for routing screened calls are possible. In Figure 5a, calls come directly into the system, are screened, and either handled autonomously or routed to the ACD or PBX. This configuration is appropriate for applications in which the majority of incoming calls can be automatically handled by the system. The configuration of Figure 5b is desirable in situations where the majority of calls cannot be automatically handled, perhaps because of the complexity of the transaction or lack of automatic access to a data base. Here the system merely screens the call and disposes of it by transferring it to the proper attendant pool.

Outward Call Management. Other customers are using the call system's generation capability to call credit card holders with account irregularities. The system obtains a list of particular card holder phone numbers from a host computer and automatically places the calls. The progress of each call is monitored. When a call is answered, it is immediately transferred to an idle attendant and a message is sent to the host computer, which displays the person's account information on the attendant's video screen.

Calls failing to complete are handled according to the detected disposition. Calls encountering a busy signal are redialed after a few minutes. Calls encountering no answer are redialed after a much longer period. Those calls encountering network announcements—for example, calls to disconnected numbers—are not retried but reported to the host computer.

Voice Messaging. The voice coder subsystem is used to encode and store on disk a message spoken by the caller. The caller also touch-tone dials the phone numbers of the intended recipients. The system makes the outgoing calls and verbally delivers the message. To allow for mass distribution of messages, the caller can maintain a list of recipient phone numbers on the system disk.

Future Enhancements

Planned enhancements to the system include an expanded interface to the telephone network and additional

subsystems. A digital T1 line interface to the system is being developed to simplify the interface to the central office and significantly reduce the amount of per-trunk hardware. Other enhancements involve adding new subsystems that can be switched onto a call. Two such subsystems with emerging markets are described below.

Speaker Verification. With speaker verification, the system will be able to ask a caller to enter an identification number and speak a special password or phrase. The entered identification will be used to access a file containing the same password or phrase spoken earlier by the caller. A comparison, similar to a template match in speech recognition, is then made between the spoken password and the one on file. If the match is close enough, the caller is assumed to indeed be the owner of the entered identification and the transaction proceeds. Otherwise, an announcement informs the caller that his or her voice does not match the entered identification. In a practical system, the caller would normally be given two or three verification chances before the system would disconnect.

The algorithm used to make the voice comparisons will be implemented on the SP board and is similar to that described in References 11 and 12.

Text to Speech. A text-to-speech subsystem would allow written information to be spoken to a caller. This eliminates the time and effort required to record and edit speech files and allows arbitrary messages to be easily added or modified. In addition, textual messages require much less disk space than spoken messages.

Algorithms that synthesize speech from text use various pronunciation rules and a large data base for converting letter sequences or phonemes to speech data. At present, text-to-speech algorithms produce somewhat unnatural sounding speech. Efforts are under way to improve the speech quality of text-to-speech systems.

Summary

The Conversant 1 voice system is the basic vehicle leading AT&T into the arena of commercial speech systems. Its flexibility in attaching various subsystems to calls allows it to incorporate new technology as it emerges. The commercial use of voice systems is still in its infancy but rapidly expanding, and expectations for its growth over the next decade are very high. AT&T intends to play a significant role in shaping this market in the coming years.

References

1. Tsutomu Takahashi et al., "The SR-2000 Voice Processor and Its Applications," *Speech Technology*, Vol. 2, No. 4, February-March 1985, pp. 22-29.
2. Lynette Gutcho, "DECtalk—A Year Later," *Speech Technology*, Vol. 3, No. 1, August-September 1985, pp. 98-102.
3. L. R. Rabiner and S. E. Levinson, "Isolated and Connected Word Recognition—Theory and Selected Applications," *IEEE Trans. on Communications*, COM-29, No. 5, May 1981, pp. 621-659.
4. J. G. Wilpon and L. R. Rabiner, "A Modified K-Means Clustering Algorithm for Use in Speaker Independent Isolated Word Recognition," *IEEE Trans. on Acoustics, Speech, and Signal Processing*, ASSP-33, No. 3, June 1985.
5. J. L. Boddie et al., "Digital Signal Processor: Architecture and Performance," *Bell System Technical Journal*, Vol. 60, No. 7, September 1981, pp. 1449-62.
6. B. S. Atal, "A New Model of LPC excitation for Producing Natural-Sounding Speech at Low Bit Rates," *Proceedings*, Intl. Conference on Acoustics, Speech, and Signal Processing, 1982, Paris, pp. 614-17.
7. R. E. Crochiere, S. A. Weber, and J. L. Flanagan, "Digital Coding of Speech in Sub-bands," *Bell System Technical Journal*, Vol. 55, No. 8, October 1976, pp.1069-1085.
8. R. E. Crochiere, R. V. Coy, and J. D. Johnson, "Real-Time Speech Coding," *IEEE Transactions on Communications*, Vol. COM-30, No. 4, April 1982, pp. 621-634.
9. J. G. Josenhans et al., "Speech Processing Applications Standards," *AT&T Technical Journal*, Vol. 65, No. 5, September/October 1986, pp. 23-33.
10. H. L. Andrews, "Speech Processing," *Computer*, Vol. 17, No. 10, October 1984, pp. 315-24.
11. Sadaoki Furui, "Cepstral Analysis Techniques for Automatic Speaker Verification," *IEEE Trans. on Acoustics, Speech, and Signal Processing*, ASSP-29, No. 2, April 1981, pp. 254-272.
12. F. K. Soong et al., "A Vector Quantization Approach to Speaker Recognition," *Proceedings*, Intl. Conference on Acoustics, Speech, and Signal Processing, 1985, Tampa, pp. 387-390.
13. "AT&T Personal Computer 6300 PLUS, Hardware Reference Manual" and "UNIX™ System V Release 2.0 Operations

Guide," AT&T, 1985. Order numbers 845 657 048 and 845 657 758, respectively. Available by telephone order from 800 432-6600.
14. J. G. Wilpon, "A Study on the Ability to Automatically Recognize Telephone-Quality Speech From Large Customer Populations," *AT&T Technical Journal*, Vol. 64, No. 2, February 1985, pp. 423-451.
15. S. D. Hester, "Taking the Pulse of the Network", *Bell Laboratories Record*, Vol. 60, No. 3, March 1982, pp. 70-74.

(Manuscript received July 17, 1986)

0654804204800

DOCUMENT PRODUCED

Consumer and Corporate Affairs Canada
Consommation et Corporations Canada

(11) (A) No. 1,162,336

(45) ISSUED 840214

(52) CLASS 379-3
C.R. CL. 354-34;
354-44

(51) INT. CL.[3] G06F 15/22,15/28

(19) (CA) CANADIAN PATENT (12)

(54) SYSTEM FOR ENTERING AND PROCESSING GAMBLE STAKES

(72) De Bruyn, Jacques,
Belgium

(21) APPLICATION No. 368,134

(22) FILED 810108

(30) PRIORITY DATE Belgium (2/58328) 800110

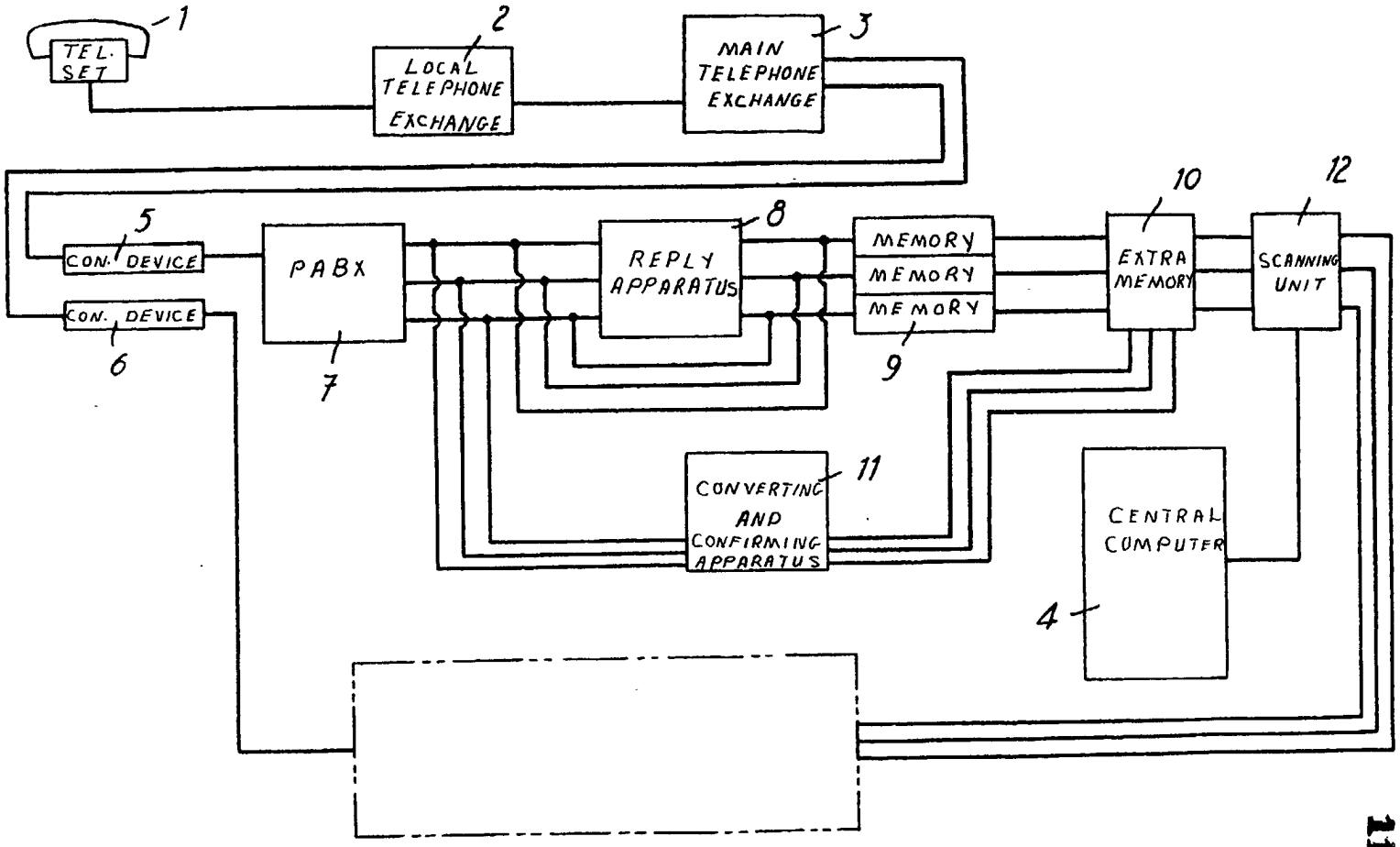
No. OF CLAIMS 4

6954-4420 Québec Inc.

Canada

DISTRIBUTED BY THE PATENT OFFICE, OTTAWA.
CCA-274 (11-82)

BESTEO" FR2062260



1162336

The present invention is concerned with a device for permitting the use of the telephone for immediately entering a gambling stake, right up to a short time before the drawing of the winning numbers, on the Lotto or on any other authorized game of chance.

Up till now it was required, in order to be able to participate in the game of Lotto, to collect a prescribed form from a recognized distributor, to fill in this form and to return it. Subsequently these forms had to be checked by the Lotto authorities in order to designate the winning participants.

The main drawbacks to this manner of proceeding are that an unnumerable number of printed forms are required, which then have to be distributed all over the country and that one can only take part in the game up to a relatively long time before the actual drawing starts. A further important drawback is that the unabled, who has no possibility of transportation, is unable to take part in the game without calling upon the aid of other people.

In order to avoid the aforesaid drawbacks and in accordance with the broad concept to the present invention, there is provided and claimed herein a system for entering and processing gambling stakes, comprising:at least one reply apparatus, for connection to a telephone exchange to which a subscriber's telephone is connected, to permit instructions concerning the game to be given to that subscriber; a memory connected to said reply apparatus for the temporary recording of the subscriber's telephone number and of selected game figures upon which the subscriber enters a stake; a convertor and reply apparatus connected to said memory and for connection to said telephone exchange, for conversion of information, recorded in said memory, into spoken language and repetition

thereof to the subscriber; a central computer connected to said memory for permanent recording of information temporarily recorded in said memory and for recording a sum of money to be charged to the subscriber, and a scanning unit connected between said memory and said central computer for transmitting information recorded in said memory to said central computer and for erasing said information entered in said memory.

Besides eliminating the previously mentioned drawbacks, the above system offers the advantage of being able to take part in the game up to a short time, one hour for instance, before the winning numbers are drawn, and that even disabled persons can take part by using their telephone. The switching in of the telephone network for the game of Lotto also is to the advantage of public Telegraph and Telephone Utilities Companies. People will moreover more readily take part in the game by phone than they would by means of printed forms. In this manner, participants who avail of very little time or who wish to place a stake at the last moment, are offered the possibility of doing so with a minimum of trouble. This device will also permit a considerable saving in personnel, so that costs are reduced and the winning participants can be very quickly determined and payed out. The relatively high cost of investment for putting to use this device according to the invention becomes totally negligible in view of the results obtained. Yet another advantage is that the commissions at present payed to the distributors could revert to the operator of the new device according to the invention.

Merely as an example, and without the slightest intent of restriction, a detailed description is given hereinafter of a preferred embodiment of the invention. This description refers to the appended drawing, which shows a block diagram of this device

For the sake of clearness, this drawing only shows one single telephone set 1, which is connected in the well known manner to the local telephone exchange 2, which in its turn is in connection with one of the main exchanges 3 which are used for international telephone traffic and to which is connected the entire Lotto computer device described hereinafter. This device may consist of several groups of electronic apparatus assembled in the same manner, each group of which is intended for the processing of a specific language and shall preferably be connected to the same central computer 4. In the present case is connected to main exchange 3 a connection device 5 and a connection device 6, which automatically and respectively connect Dutch speaking subscribers to the group for the Dutch language of the computer device and the French speaking subscribers to the group for the French language of the computer device. In consideration of the previously stated fact that both groups are assembled in the same manner, only one single group will be described hereinafter. The second group is shown in the drawing in dot-dash line. Each connection device, respectively 5 and 6 is connected to a so-called PABX apparatus 7 which distributes the telephone conversations over several telephone lines, thus considerably increasing the capacity of the device. A telephone reply apparatus 8 is connected to the outgoing lines thereof in order to give instructions to the telephone subscribers. A memory 9 is connected to each telephone line in order to record the selected Lotto figures and the subscriber's telephone number. Preferably, an extra memory 10 shall be provided in the group for the purpose of

checking the permitted number of stakes per week by one and the same player. This memory operates in conjunction with a converting and confirming apparatus 11, which will advise the telephone subscriber of the possible refusal of a certain stake. This converting and confirming apparatus 11 is also provided to be able to convert into spoken language the Lotto figures recorded in the memories 9, repeating these recorded figures to the telephone subscriber as a check. A scanning unit 12 is also provided for transmitting the information recorded in memories 9 to the central computer 4 and for subsequently cancelling the entered information.

The operation of the device described above is detailed hereinafter.

The telephone subscriber who wishes to take part in a game, such as for instance a Lotto game, hooks off the receiver from set 1 and hears the normal selector tone. After selecting, for instance the digits 00 of the automatic international service, the connection is made with the main exchange 3. After the signal is heard which precedes an international conversation, the subscriber selects the telephone number which has been awarded to the Lotto game, whereby he is automatically connected to the Lotto computer device. If we presume that the subscriber number is a telephone number which is attributed to a Dutch speaking subscriber, the connection device 5 will switch the subscriber to the group of Dutch language of the device, and the PABX apparatus 7 will set up a connection with a free line of the reply apparatus 8 which will then, for instance convey the following message : "You are connected to the central

computer of the national Lotto. After hearing the first signal, please select your first chosen number by means of the selector device of your telephone set. After each signal you select the following numbers, in arithmetical order. After your last choice of numbers, the computer will repeat the chosen numbers. Best of luck, and start now". After the numbers have been selected following each signal, the impulses brought about by the selector device are converted to computer language and stored in memory 9, so that in other words, the selected Lotto numbers and the telephone number of the subscriber are recorded. Simultaneously, a check is carried out in an auxiliary memory 10 in order to determine whether the phone number of the subscriber has already been recorded for the current Lotto game. Should this be the case, a reply apparatus which is connected to the auxiliary memory 10 will, via this memory, transmit the following message to the subscriber : "Your stake has been refused, considering you have already entered a previous stake for participation this week". In this manner, the possibility is avoided of abnormally high stakes being entered per participant, which are only charged later by the Telephone Utilities Company. When however the stake is accepted, the information of memory 9 is transferred to the conversion and reply apparatus 11, which converts the information to spoken language and informs the telephone subscriber thereof, so that the latter can check whether the correct Lotto numbers have been recorded. Subsequently, the receiver is hung up again so that the telephone connection is severed. The conversion and reply apparatus 11 may be of any type whatever and may comprise a number

of electronic switches, so-called gates, as well as for instance fourty different tape tracks, which can be fed in one at a time, as and when these tracks are switched on by the preselection of the gates. After the receiver has been hooked back, an impulse is transmitted to memory 9, which passes on the subscriber's number and the selected Lotto numbers to the scanning unit 12 and to the central computer 4, in which all the information is recorded on computer tape, after which the scanning unit erases the transmitted information in memory 9, so that space becomes free in thismemory for new information. Should the telephone subscriber not agree with the repeated numbers, he may for instance select the digit 0 on his phone selector, whereby the information in memory 9 is erased and the amount of the stake is not charged. In such a case, only the phone call will be charged, and the subscriber may start over again.

The charges for the stakes can be determined in accordance with the number of selected figures, and in order to avoid abnormally high stakes, a maximum amount can be preset which, when exceeded, would be refused by the computer device. The computer device would also refuse a stake, when for instance figures are selected which do not correspond to the Lotto figures.

The device described above will identify the subscriber and charge him the phone call and stake costs on his usual telephone bill, which shall also state the selected Lotto figures and the cost of the stake.

In order to select the players, the Telephone Company may, should it wish to do so, attribute a secret code to each

player, which should then also be dialed in order to obtain the connection with the computer device.

Before the drawing of the winning numbers is started, the magnetic tape of the central computer 4 is sealed and safely stored away. After the drawing, the computer is programmed with the winning numbers and the magnetic tape is then read in at high speed. As a result, the computer documents will state the phone numbers of the participants, the number and the value of the selected figures and the amount which is charged on the telephone bill. The winners of prizes are identified and payed out with a check or by any other means.

It is perfectly obvious, that some of the above described components of the device could be replaced by others which pursue the same purpose and that other combinations of the components previously described could be considered, as long as they remain within the scope of the invention.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. System for entering and processing gambling stakes, comprising:

(i) at least one reply apparatus, for connection to a telephone exchange to which a scubscriber's telephone is connected, to permit instructions concerning the game to be given to that subscriber;

(ii) a memory connected to said reply apparatus for the temporary recording of the subscriber's telephone number and of selected game figures upon which the subscriber enters a stake;

(iii) a convertor and reply apparatus connected to said memory and for connection to said telephone exchange, for conversion of information, recorded in said memory, into spoken language and repetition thereof to the subscriber;

(iv) a central computer connected to said memory for permanent recording of information temporarily recorded in said memory and for recording a sum of money to be charged to the subscriber, and

(v) a scanning unit connected between said memory and said central computer for transmitting information recorded in said memory to said central computer and for erasing said information entered in said memory.

2. System as defined in claim 1, in which an auxiliary memory is provided in the device in order to check the number of stakes entered for one same game by the

telephone subscriber.

3. System as defined in claim 1, in which an apparatus is connected between the telephone exchange and the central computer for a telephone line distributor, with a memory on each telephone line, for the temporary recording of the telephone number of the telephone subscriber and of the selected figures upon which a stake is entered.

4. System as defined in claim 1, in which there are connected between the telephone exchange and the central computer for each spoken language, a reply apparatus and a conversion and reply apparatus in the language concerned.

BESTEO: 14.09.2020

ABSTRACT OF THE DISCLOSURE:

Device permitting the use of the telephone for entering stakes on the Lotto or on any other authorized game of chance. It comprises a reply apparatus connected to the telephone exchange of the Telegraph and Telephone Utilities Company, in order to give instructions concerning the game to the telephone subscriber who wishes to take part in the game, as well as a central computer in order to record the phone number of the telephone subscriber, the selected figures or other symbols upon which the stake is entered, as well as the amount to be charged to the telephone subscriber.

b6 per FBI
b7C per FBI

Voice Response Systems—Technology to the Rescue for Business Users

A variety of business messages and transactions are simplified when voice response technology takes over the telephone lines.

S. Thomas Emerson

President
Periphonics Corporation
Bohemia, N.Y.

FROM THE EARLY tape storage devices to today's sophisticated speech generation systems, the keys to the acceptance of voice response technology have been ease of use and cost savings for the end user.

The first voice response systems of a generation ago provided direct data-base access for people working in the branch offices of banks and other financial institutions. These systems allowed access from remote locations to such information as account balances and credit lines. They did so without the expense of computer terminals or special communication lines, using standard push-button telephones.

During this same period, consumers began to deal with computers that could talk. Such interactions took place primarily through telephone installations for reporting misdialed and changed phone numbers. But financial institutions also entered the talking computer arena through bill-paying and bank-from-home services. These services were an early and important step in reducing the amount of paper handled and also permitted routine transactions to be serviced with fewer personnel and branch offices. Bank-from-home systems preceded the now common automatic teller machines by several years.

Two recent innovations in voice response technology have made it more usable and acceptable to a variety of users. These are the ability of a single system to handle both voice and data on the same communications line and the ability of a user to change the transaction content and the actual spoken responses.

By treating the telephone as just one of several input devices to a system, voice response enhances the user's operation instead of working as a separate entity. The system automatically determines the type of device on the line and selects the appropriate response medium—speech or data. Thus all input points can be serviced through a single system and all inputs to the mainframe computer converted into the proper format.

One Line for Voice and Data

A good example of the benefits of handling voice and data on one set of telephone lines is in credit authorization applications. In this case, a credit card issuer may need to certify a sales authorization by telephone from some locations, but through special terminals or electronic cash registers from others. Handling both types of authorization over one set of lines leads to economies of scale.

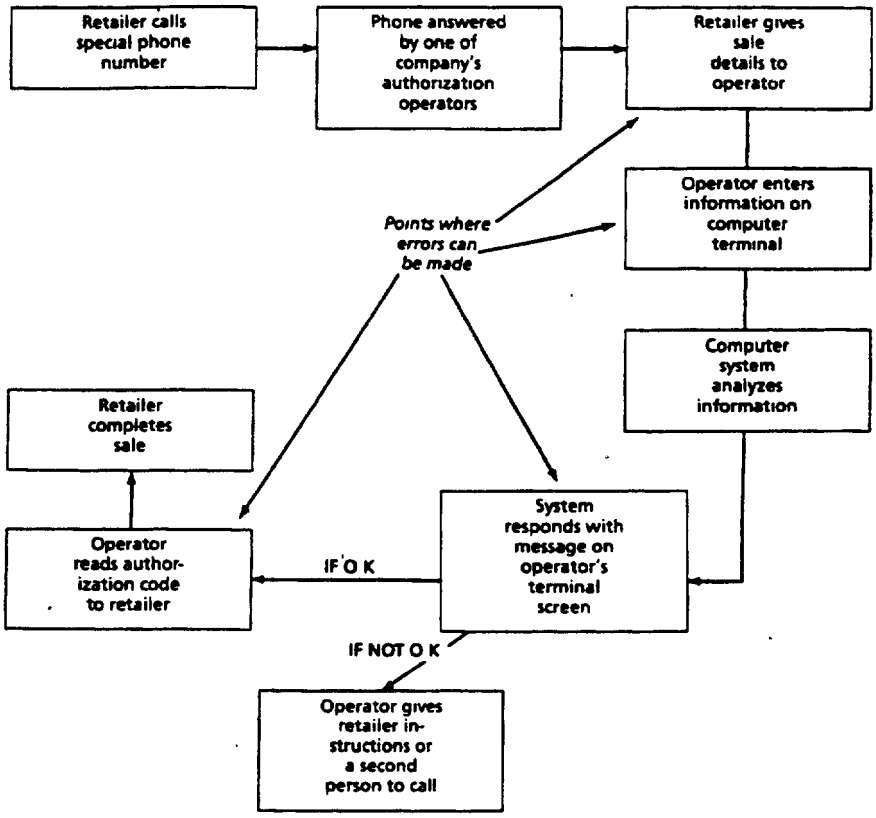
For retail stores, a more important feature of such a system is that no recalls are necessary when a problem occurs. The credit card issuer simply sends a "pick up the phone" message to the terminal—which can be displayed as a special response code. The system switches to the voice mode as soon as the sales clerk comes on the line. Thus, the communications system is easy for retailers to use.

With the appropriate system, a user can modify the manner in which the system manages different types of transactions, and he can modify the messages and responses at any time. These capabilities are particularly important in nonfinancial applications in which seasonal and detail changes are frequent. For example, assume a company wishes to change the way its system answers the phone from "hello" to "season's greetings." In addition, it may want to

change the description of an item from "shipped in cases of six" to "shipped in cases of twelve." If the system doesn't allow the user to change messages, he must return to the system manufacturer for changes, which will likely be costly and time-consuming.

Simple authorization of an action is one application area turning increasingly to voice response technology. Systems being installed today can authorize the acceptance of credit cards and checks, repairs under warranty and the shipment of merchandise.

Fig. 1



Without a voice response system, credit card authorization is a complex, costly, and error-prone process. Most errors result from the "human interface"—data is incorrectly entered by an operator or incorrect data is given to the caller.

Credit card authorizations illustrate how voice response technology gives users system flexibility at dramatically reduced costs. Issuers of credit cards are subject to fraud and misuse of the cards. To prevent such actions, they set up a complex and costly procedure for verifying each use of a card. For small sales—low dollar amounts—cards are checked by sales clerks using periodically published listings of "hot" (stolen) cards. High dollar amounts must be confirmed by telephone calls to authorization centers—which are rooms full of operators answering phone calls and entering data into computer terminals (Fig. 1).

This process is both costly and cumbersome. Staffing an authorization center to deliver service when it is needed presents logistical problems, supervision difficulties, and high equipment costs. The problems are magnified in terms of idle equipment standing by to work at peak times or during peak seasons.

To eliminate some of these problems, issuers have installed either direct authorization links to electronic cash registers or have special authorization terminals. But these provide only a partial solution. Electronic registers are located only at high-volume sales points, and terminal networks are expensive to purchase and to service. Furthermore, neither completely eliminates the need for authorization centers.

Voice response technology, either in combination with terminals and electronic cash registers or acting alone, gives a credit card issuer the means to completely automate his entire operation. Moreover, the

Speak your mind.



Vocabulary development is easy with **Adisa's** new vocabulary development system. Supporting the

TI 5220 or **GI SP-250**
on **Intellec®** • **MDS** under **Isis II®**
or **S-100** (IEEE 696 compatible)
under **CP/M80,®**

the VPP series allows you to code unique vocabulary sets for the TI 5220 or GI SP-250 without breaking your development budget.

THE VPP Series features:

- DMA Voice Digitizing and Playback
- Parameter Extraction and Coding
- Screen Oriented Parameter Editor
- Voice Synthesis

Ask us to send you our informative brochure on the VPP Series. For a package including hardware and software:

$3900

Complete systems are also available.

adisa corporation
APPLIED DIGITAL SIGNAL ANALYSIS
P.O. Box 1364 Palo Alto, CA. 94301
(415) 326-7303
CP/M-Digital Research Inc.; Isis II, Intellec-Intel.

FOR INFORMATION CIRCLE 126 ON READER CARD

issuer need only maintain a small staff to handle difficult or unusual calls.

How the Voice Response System Works

When a call comes in on a voice response system, the system must be able to determine whether it is a voice or a data call (voice and data enter on the same set of lines). The system then automatically switches to the appropriate communications mode.

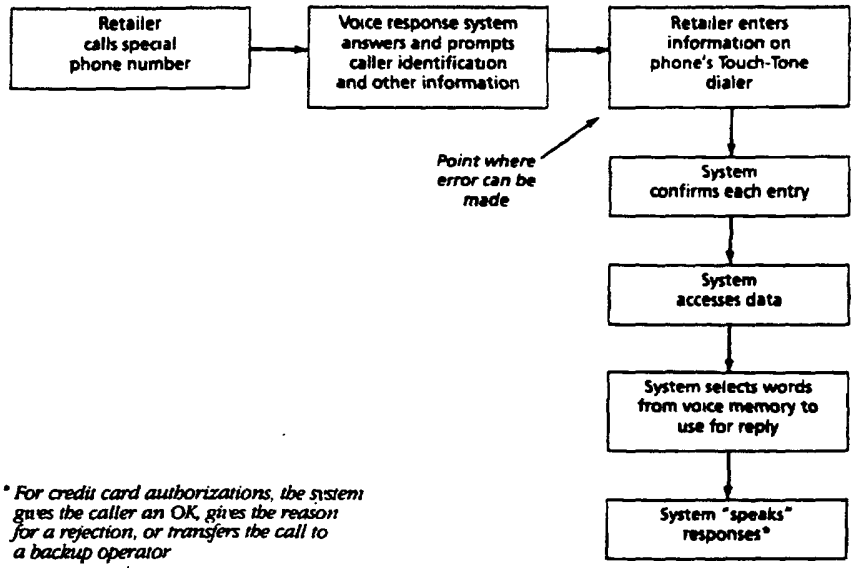
As illustrated in Fig. 2, a Periphonics system answers the phone and "speaks" a predetermined greeting by selecting words and phrases from its digital memory. Then, depending on the system's function, it may request the caller's identity—a customer or user number—and ask what information the caller needs. In an order entry system, for example, the question could be whether the caller wants to enter, cancel or check the status of an order. The caller responds by way of the Touch-Tone dialer on his phone, entering the code number or letter for the functions he or she wants to perform.

Once the voice response system identifies the caller and his needs, it must locate the necessary data base, which is either in its own memory or in that of another computer system. It does so by converting the Touch-Tone inputs into the format of the proper data base. The system then accesses memory in a manner similar to that used by a standard computer terminal. When data are returned, the system uses predetermined instructions to formulate an answer for the caller. The words and phrases are drawn from its own memory. An answer is "spoken" over the phone, followed by a second set of prompts to continue the transaction. This sequence of operations is repeated until the reason for the call is satisfied. Some systems can also switch the caller to an operator if the system cannot fulfill the caller's request.

At the core of the Periphonics system is the T-Comm 80, an intelligent communications processor. Designed for total network control, the processor provides host-software compatibility and makes terminal communications completely independent of the host processor. The latter permits the host to concentrate on its primary task, processing data.

T-Comm 80 can support any combination of voice response lines, plus asynchronous, synchronous, or SDLC (Synchronous Data Link Control) terminals from different vendors. It converts all these into a common interface and access method with the host computer. It also supports communications with and between up to seven independent host systems, either through channel attachments or through a communications port. Message switching is based on the originating terminal or message content. In any case, there is no need for host intervention.

Fig. 2



* *For credit card authorizations, the system gives the caller an OK, gives the reason for a rejection, or transfers the call to a backup operator*

A much simpler credit card authorization process is possible using a voice response system. Here, a person enters the loop only in the few instances in which the electronics portion cannot provide the necessary information. Note that there is only one point where human errors can be made and that confirmation should virtually eliminate them.

A Voice Response Application

A major oil company with credit card



DR. S. THOMAS EMERSON *is the president of Periphonics Corporation, a leading manufacturer of voice response systems. A founder of the company, he holds several patents covering its speech storage and generation technology. Earlier, Dr. Emerson held a research position with Brookhaven National Laboratory, Upton, NY. He earned a BS degree in physics from the Massachusetts Institute of Technology and MA and PhD degrees in physics from Rice University.*

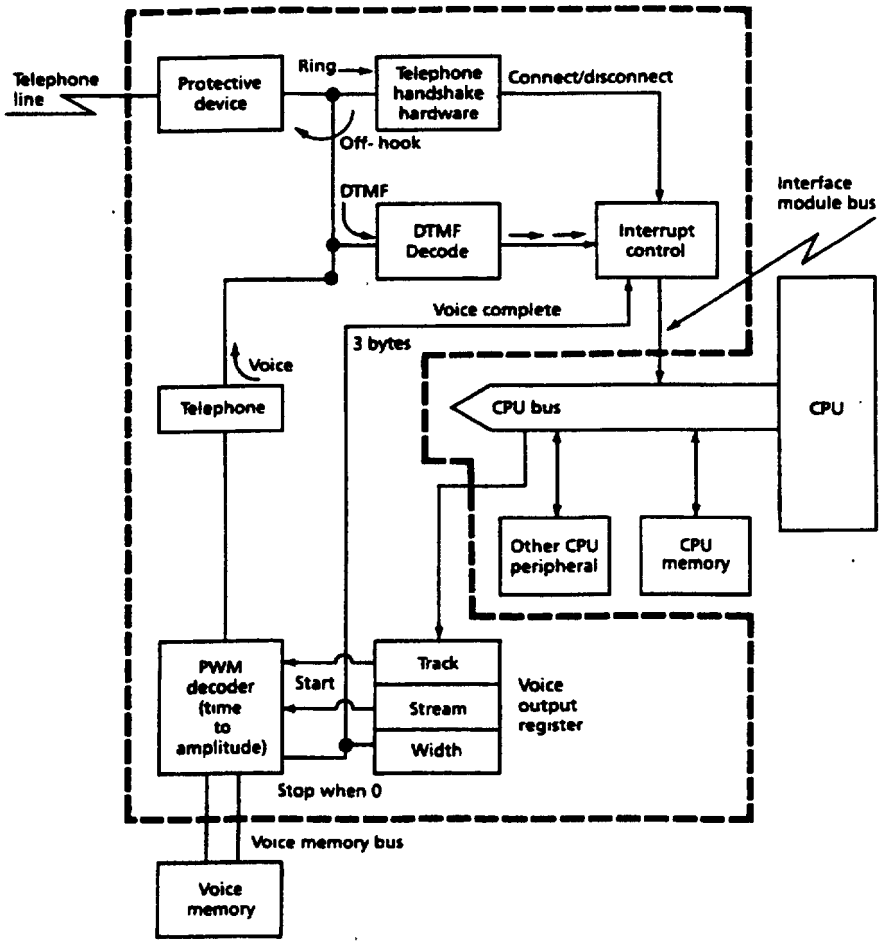
Making a Computer Talk

THE TWO KEY FACTORS in the commercial acceptance of a voice response system are the quality of its voice and the system's ability to accurately and economically issue spoken responses to a large number of telephone lines simultaneously.

To create a high-quality system voice, Periphonics employs a five-step process. The process is built around special recording studios and equipment designed primarily for that purpose. First, starting with a script of all phrases and words that the system needs to "speak," trained audio technicians reduce the script to its recording format. That means eliminating all redundancies and duplications. Second, the recording script is recorded by a trained speaker. During the recording session, each word—called an audio item—is recorded about 15 times.

Third, using special equipment, the recorded words and phrases are electronically edited. Then the best version of each word or phrase is selected for actual system use and adjusted for pitch, tone, and volume. Fourth, the final recorded version of the words and phrases is edited further to eliminate extraneous voice and mouth sounds and adjusted to the bandwidth of the telephone system.

At this point, the recording is still in an analog-signal format. In the fifth step, through a special encoding process, the analog signals are converted into digital form and stored on floppy disks, each holding about 24 seconds of speech. The disks ("diskettes") are used to load the vocabulary into the system's solid-state memory.



High-quality digitized speech requires high data transfer rates—typically 56 kbits/s for *each* connected phone line. An independent voice response controller manages the transfer of this digital data. The ability of the voice response controller to provide parallel data transfer to many connected telephone line interfaces is essential for a system which can hold many simultaneous "conversations" without degrading the quality of speech or any single line.

The central processing unit receives decoded DTMF tone inputs from the individual telephone line interface cards. It "speaks" the response to the appropriate telephone line by providing the voice response controller with parameters which specify voice response vocabulary items to be played back. A vocabulary item can vary in duration from 135 ms to 17 s and is specified to the voice controller by just 3 parameter bytes received from the CPU. Sentences are composed of concatenated items.

The voice memory is organized into tracks and streams as shown. Each track contains 17 s of speech information. Tracks are composed of streams, each containing 135 ms of speech information. Thus 128 streams make up one track. Track information is fed to a PWM (pulse-width modulation) decoder which converts time-varying signals into amplitude-varying signals suitable for transmission over the phone lines.

operations in the Midwest was handling 300,000 calls a month at its authorization center. That required a staff of 44 operators, plus supervisors. The authorization process contained four critical points that are subject to errors, and three out of the four were subject to human error (see Fig. 1 again).

With the cost of gasoline rising, the oil company was faced with two obvious choices. The first was to rapidly increase the center's capacity. That would require additional staff, more equipment, and larger facilities. The second choice was to raise the "floor limit"—the sale amount for which the gas station must phone the center and obtain authorization before accepting the customer's card. However, an estimate of raising the floor limit by $10 predicted that "bad card" losses would double.

Since the company had over 17,000 outlets, the cost of installing a sufficient number of terminals and support communications lines to handle the expected increase in calls was prohibitive.

Periphonics installed the voice response credit card authorization system shown in Fig. 2 for the oil company in the fall of 1981. Within 60 days the system was handling 400,000 calls a month—a 25% increase—but with a staff of just 11 operators (down from the previous 44). The cost per call dropped by 60% and the bad-card acceptance rate had also fallen. In fact, operating cost savings paid for the system in less than six months.

There are two interesting aspects to the story. First, one of the supposed drawbacks of voice response technology is its dependence on tone-generating telephones. The oil company gave its dealers two options: either install tone-generating phones or purchase low-cost adapters. After one month, all but a handful of outlets were on the system. The second aspect illustrates how dramatic industry acceptance becomes when a system is effectively designed and implemented. Since the first installation, Periphonics has installed similar systems for six of the seven major oil companies in the U.S.

Voice Response in Order Entry

For most companies, order processing is a time-consuming, expensive operation. Customers must fill out forms and mail them. Upon receipt, the envelopes must be opened, checked, and key-punched into the order entry system. In addition to the costs and possible errors involved, the company always works with old data in calculating inventory and cash flow in that it is always making assumptions about orders in the mail based on past experience.

One solution to the problem is a telephone order-taking system in which operators sit at computer terminals and take orders over the phone. This approach eliminates the uncertainty about what is in the mail but it imposes extensive costs similar to those of the credit card authorization centers.

A better solution is voice response technology. Using different access codes for customers, sales people, and managers, voice response systems automatically accept, confirm, change, delete, and report on orders without the expensive terminals and communications lines of authorization centers. The key features of Periphonics' voice response systems—the ability to handle voice and data on one set of lines and the means to alter transaction and message content—are particularly important in order entry applications. For example, companies can give preferred customers terminals for high-volume ordering and change the content of the call and the responses to it when products or prices are altered.

A major U.S. pharmaceutical company, for instance, found that voice response significantly increased order speed while reducing both costs and errors. The key to this success is the quality of the system's voice. Previously, the company used a small system having a very mechanical voice quality. Consequently, it was avoided by sales staff and customers alike. The installation of a high-quality voice plus the other features of voice response technology made the difference. The new system now handles a large percentage of the company's orders without order forms or the assistance of operators.

Interestingly, the new system also changed ordering patterns. For example, the company began to receive orders during the middle of the night. The reason was that hospitals transferred the supply and ordering tasks from their overloaded day pharmacists to their night pharmacists. Not only was the day-shift workload eased, but orders often arrived at the pharmaceutical company one day earlier.

Voice Response Ranges Far and Wide

Voice response technology has found its way into a wide variety of business and non-business applications. In the government area, people in Clark County, Nev., report for jury duty by calling a voice response system, rather than sitting in a juror's waiting room. This scheme saves money for the county and is less annoying to jurors.

Several retail-store chains use voice response to report store performance, getting the information to management faster and more accurately. Major automobile manufacturers use such systems to validate the status of warranties and vehicle recalls.

Several airlines have found voice response an effective tool for taking reservations from their best customers and for locating lost baggage. Cable TV operators are turning to voice response to take orders for programming changes from subscribers and to offer advertisers efficient telephone order-taking service.

Bankers around the country find voice response a logical alternative and enhancement to automatic teller machine networks. It gives consumers access to account information and provides the ability to transfer funds and make inquiries without visiting a branch. Some banks have opened systems to the public for receiving automatic interest-rate quotations. In Ecuador, the Banco del Pacifico uses the technology to provide a wide range of in-office and bank-at-home services. One service is a direct computer link to the SWIFT international banking network, which permits a person in Ecuador to sit in his home and, using the bank's voice response system, trade shares on European exchanges.

The keys to these successes stem from the technology's cost-effectiveness and its ability to respond in a clear, understandable, humanlike voice. Of course, voice response technology cannot exist alone, nor is it the complete solution to all problems. But it enhances and works with other data-entry equipment to provide a full set of data communications alternatives to the business community.

FOR FURTHER INFORMATION

Contact Dr. S. Thomas Emerson, President, Periphonics Corporation, 4000 Veterans Memorial Highway, Bohemia, NY 11716; (516) 467-0500.

Boston Public Library
Copley Square

United States Patent [19]

Mueller-Schloer

[11] **4,438,824**

[45] **Mar. 27, 1984**

[54] **APPARATUS AND METHOD FOR CRYPTOGRAHIC IDENTITY VERIFICATION**

[75] Inventor: **Christian Mueller-Schloer**, Voorhees, N.J.

[73] Assignee: **Siemens Corporation**, Iselin, N.J.

[21] Appl. No.: **256,523**

[22] Filed: **Apr. 22, 1981**

[51] **Int. Cl.**[3] **H04L 9/00**

[52] **U.S. Cl.** **178/22.08**; 178/22.11; 178/22.15; 340/825.34

[58] **Field of Search** 178/22.08, 22.15, 22.11; 340/825.32, 825.33, 825.34; 235/379, 380, 382

[56] **References Cited**

U.S. PATENT DOCUMENTS

3,764,742	10/1973	Abbott et al.	178/22.08
3,798,605	3/1974	Feistel	178/22.08
4,004,089	1/1977	Richard et al.	178/22.15
4,148,012	3/1979	Baump et al.	340/825.32
4,193,131	3/1980	Lennon et al.	178/22.08
4,218,738	8/1980	Matyas et al.	178/22.08
4,264,782	4/1981	Konheim	178/22.08
4,315,101	2/1982	Atalla	178/22.08

FOREIGN PATENT DOCUMENTS

2060233	4/1981	United Kingdom	178/22.08

OTHER PUBLICATIONS

Lagger, "Sicherheitsaspekte in Rechnergesteverten Kommunikationssystemen," Elektronische Rechenanlagen, 1980, pp. 276–280.

Needham, R. M., Schroeder, M. D., "Using Encryption for Authentication in Large Networks of Computers", Communic. ACM 21,12, (Dec. 1978), 993–999.

Rabin, M., "Digitalized Signatures", Foundations of Secure Computing, R. Demillo et al., Eds., Academic Press, New York, 1978.

Merkle, R. C., Hellman, M. E., "Hiding Information and Signatures in Trapdoor Knapsacks", IEEE Trans. Inf. Theory, vol. IT-24, No. 5, Sep. 1978.

Shamir, A., "A Fast Signature Scheme", MIT/LCS/T-M-107, Jul. 1978.

Diffie, W., Hellman, M. E., "New Directions in Cryptography", IEEE Transactions on Information Theory, vol. IT-22, No. 6, (1976), pp. 644–654.

McEliece, R. J., DSN Progress Report 42–44, 1978.

Kolata, G. B., "New Codes Coming into Use", Science, vol. 208, 1980, pp. 694–695.

National Bureau of Standards, Federal Information Processing Standard FIPS Publication 46, U.S. Department of Commerce, Washington, D.C., (Jan. 1977).

M. E. Hellman, "The Mathematics of Public-Key Cryptography", Scientific American, vol. 241, No. 2, (Aug. 1979).

Rivest, Shamir, Adleman, "A Method for Obtaining Digital Signatures and Public-Key Cryptosystems", Communications of the ACM, vol. 21, No. 2, (Feb. 1978).

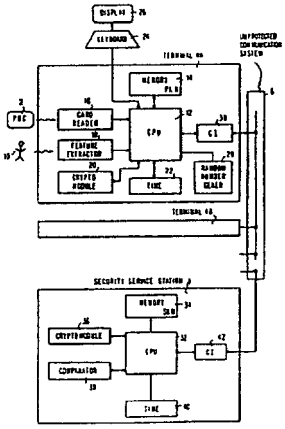
Primary Examiner—Sal Cangialosi

Attorney, Agent, or Firm—Karl F. Milde, Jr.

[57] **ABSTRACT**

The apparatus for identity verification using a data card contains at least one terminal and a security service station. The terminal(s) and the station are connected to each other via a communication system. The terminal is provided with a central processing unit including a memory, a card reader for reading data from the data card, a sensor or number input device for introducing personal identification information, and a crypto module. The crypto module encrypts and decrypts data received from the memory under the control of the central processing unit. The security service station likewise also contains a central processing unit including a memory, and a crypto module. This station also contains a comparator for comparing personal identification information with reference personal identification information. Both kinds of information are transmitted to the station from the terminal.

8 Claims, 8 Drawing Figures



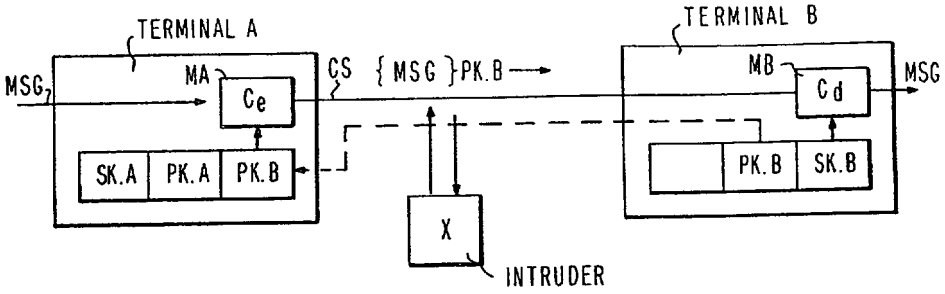


FIG. 1 PRIOR ART

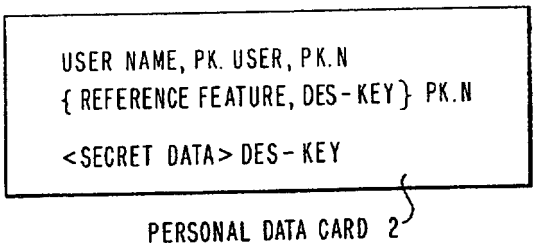


FIG. 4

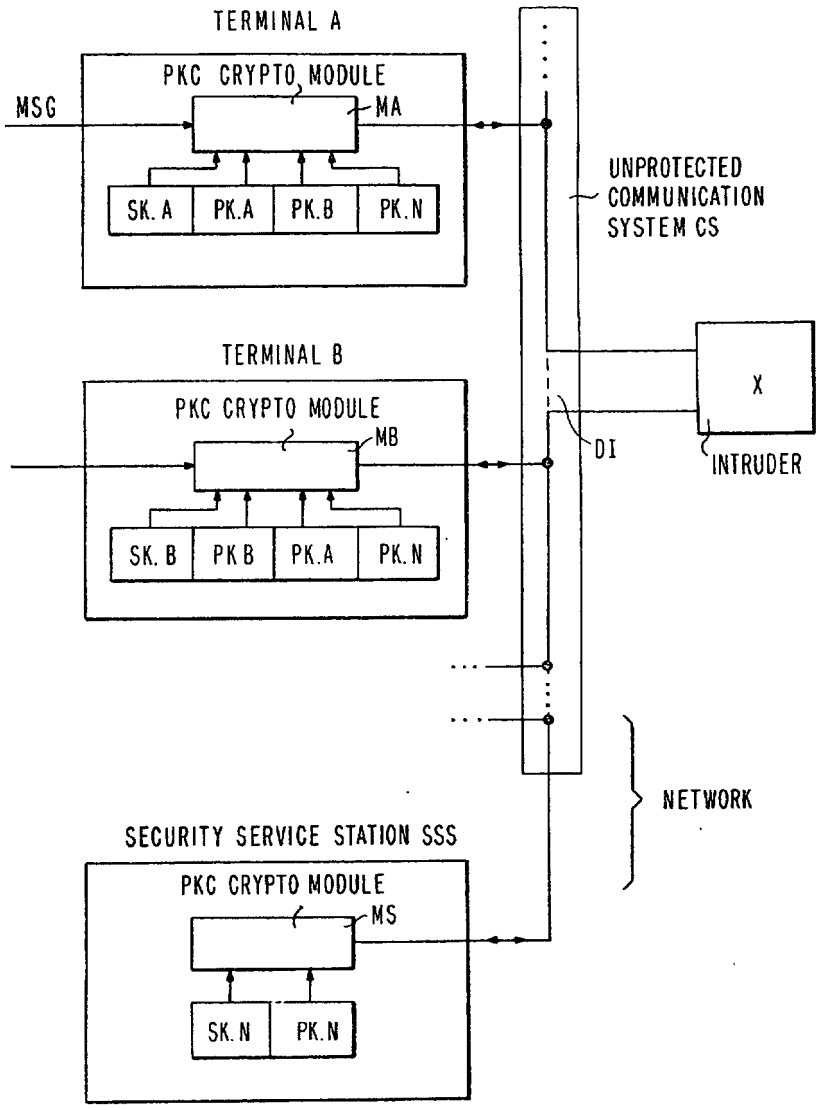

TERMINAL A
PKC CRYPTO MODULE
MSG
MA
SK.A
PK.A
PK.B
PK.N
UNPROTECTED
COMMUNICATION
SYSTEM CS
TERMINAL B
PKC CRYPTO MODULE
MB
SK.B
PKB
PK.A
PK.N
X
DI
INTRUDER
NETWORK
SECURITY SERVICE STATION SSS
PKC CRYPTO MODULE
MS
SK.N
PK.N

FIG. 2

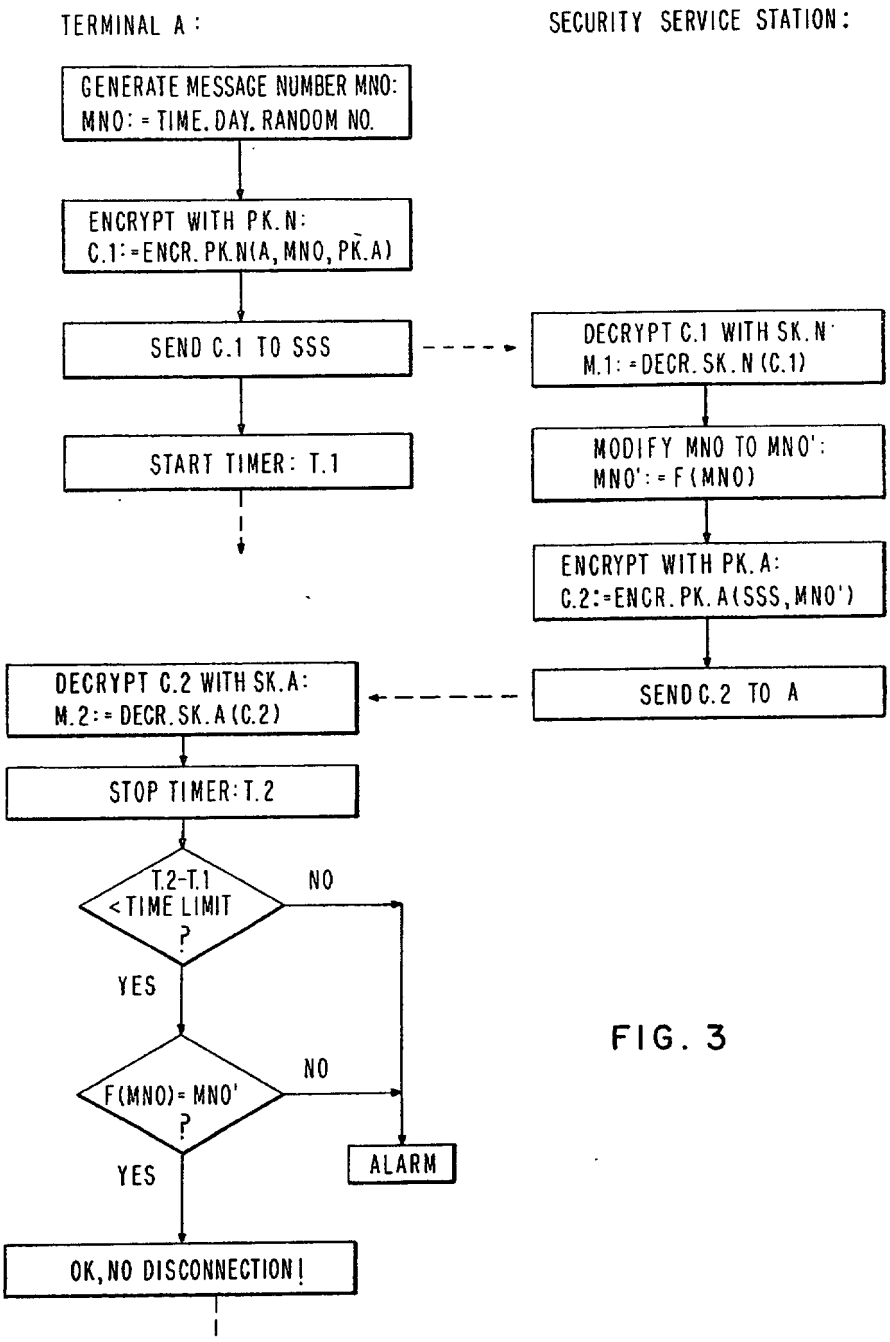

TERMINAL A :
SECURITY SERVICE STATION:
GENERATE MESSAGE NUMBER MNO:
MNO: = TIME. DAY. RANDOM NO.
ENCRYPT WITH PK.N:
C.1: = ENCR. PK.N(A, MNO, PK.A)
SEND C.1 TO SSS
START TIMER: T.1
DECRYPT C.1 WITH SK.N
M.1: = DECR. SK. N (C.1)
MODIFY MNO TO MNO':
MNO': = F(MNO)
ENCRYPT WITH PK.A:
C.2: = ENCR. PK. A(SSS, MNO')
SEND C.2 TO A
DECRYPT C.2 WITH SK.A:
M.2: = DECR. SK. A (C.2)
STOP TIMER: T.2
T.2-T.1 < TIME LIMIT ?
NO
YES
F(MNO) = MNO' ?
NO
YES
ALARM
OK, NO DISCONNECTION!

FIG. 3

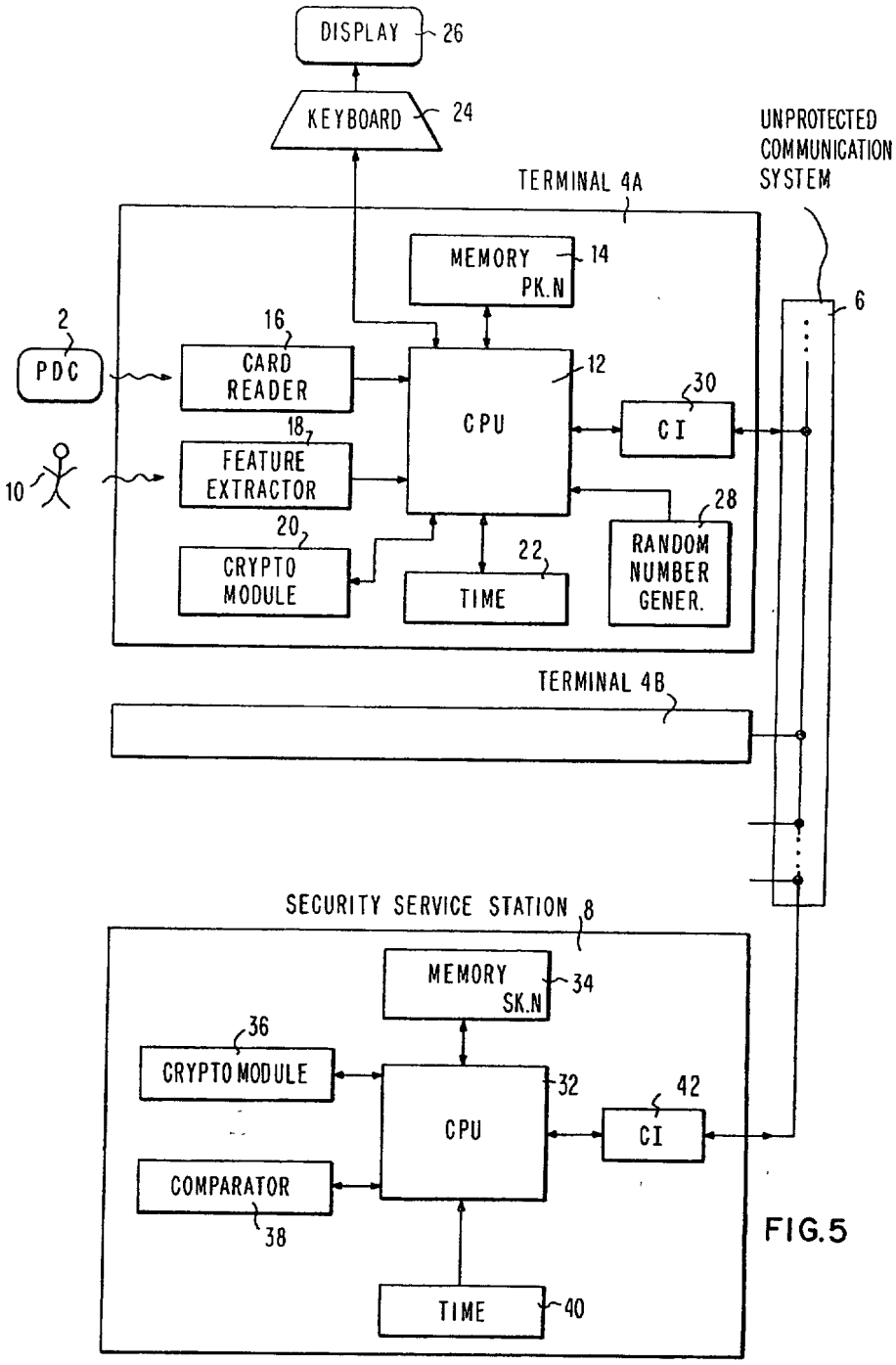

DISPLAY
26
KEYBOARD
24
UNPROTECTED
COMMUNICATION
SYSTEM
TERMINAL 4A
MEMORY
PK.N
14
6
2
PDC
16
CARD
READER
12
CPU
30
CI
10
18
FEATURE
EXTRACTOR
28
20
CRYPTO
MODULE
22
TIME
RANDOM
NUMBER
GENER.
TERMINAL 4B
SECURITY SERVICE STATION
8
MEMORY
SK.N
34
36
CRYPTO MODULE
32
CPU
42
CI
COMPARATOR
38
TIME
40

FIG.5

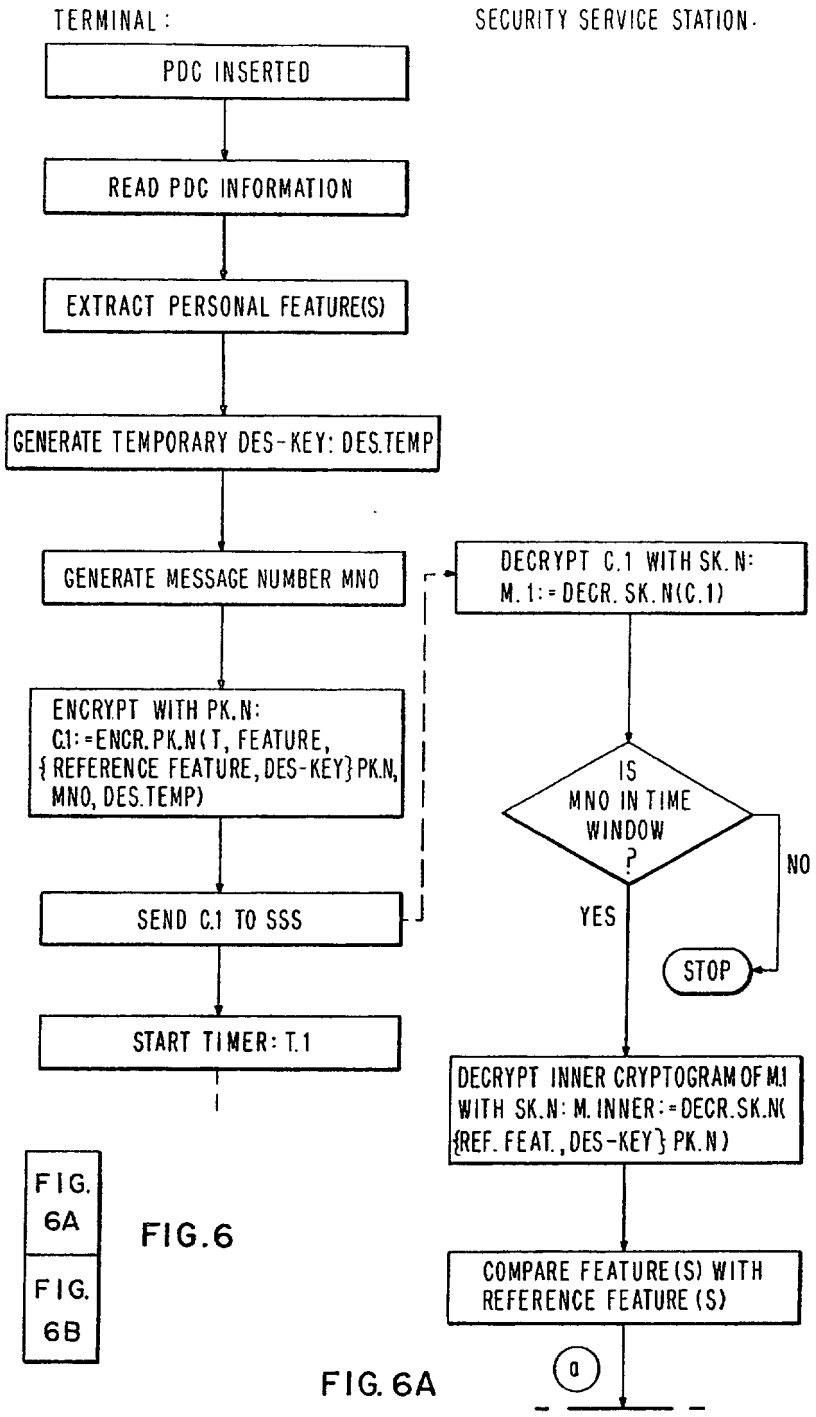


FIG. 6A
FIG. 6B

FIG. 6

FIG. 6A

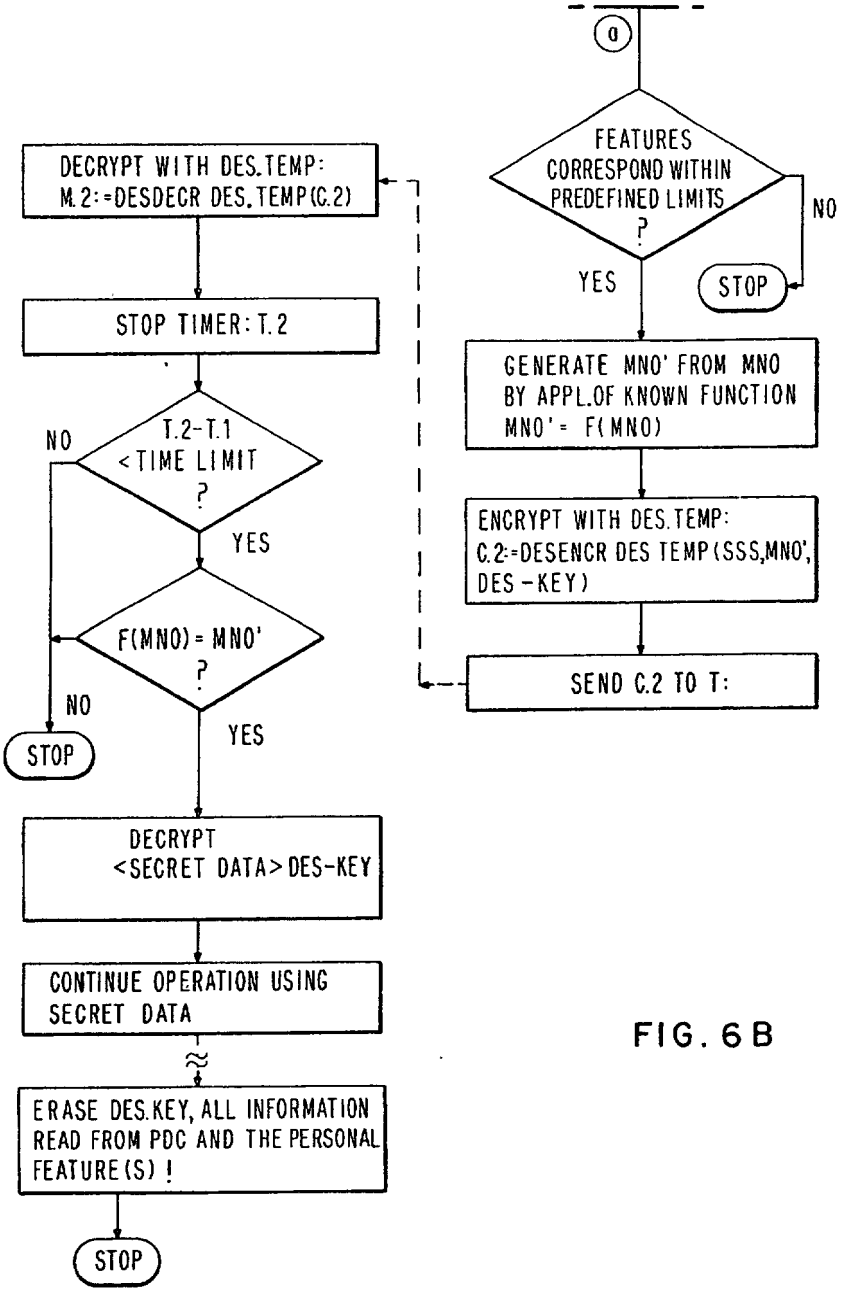

DECRYPT WITH DES.TEMP:
M.2:=DESDECR DES.TEMP(C.2)
STOP TIMER: T.2
T.2-T.1
<TIME LIMIT
?
NO
YES
F(MNO) = MNO'
?
NO
YES
STOP
DECRYPT
<SECRET DATA> DES-KEY
CONTINUE OPERATION USING
SECRET DATA
ERASE DES.KEY, ALL INFORMATION
READ FROM PDC AND THE PERSONAL
FEATURE(S) !
STOP
a
FEATURES
CORRESPOND WITHIN
PREDEFINED LIMITS
?
NO
YES
STOP
GENERATE MNO' FROM MNO
BY APPL.OF KNOWN FUNCTION
MNO' = F(MNO)
ENCRYPT WITH DES.TEMP:
C.2:=DESENCR DES TEMP(SSS,MNO',
DES-KEY)
SEND C.2 TO T:

FIG. 6B

APPARATUS AND METHOD FOR CRYPTOGRAHIC IDENTITY VERIFICATION

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to an apparatus for identity verification by means of a data card with protection against misuse of the card by unauthorized users. In particular, this invention relates to an apparatus yielding access to sensitive data stored on a personal data card only to the authorized owner. This invention also relates to a method based on cryptographic principles for identity veritication.

2. Description of the Prior Art

Plastic cards for different types of stored data are presently in wide use. Application examples are credit cards and cards bearing access control information for automatic teller machines. Such cards are used to perform authorizations.

However, these data cards suffer from some shortcomings: (A) The amount of data that can be stored on a card is limited. Presently the storage capacity is about 100 bytes. (B) The storage normally is of the read-only type. (C) It a card is lost there is only minimal protection against misuse.

In order to overcome these shortcomings, a so-called personal data card (PDC) is suggested. Such a personal data card would contain or be provided with a non-volatile (for instance, RAM type) storage device having a high storage capacity, for instance a storage capability of several kbytes. This PDC should also be provided with an effective protection against loss or unauthorized data access. Such a PDC could be used for a variety of new applications.

Examples for the kind of information that may be stored and for the usage of such a personal data card are the following:

(a) The PDC may be used as an electronic ID card containing personal data such as name, date and place of birth, height, Social Security Number, driver's license information, passport number, and address. The ID card could be used to help speed up procedures such as identifications of the owner and form fill-ins.

(b) The PDC may contain the health history of the owner combined with information about medical treatments, surgeries, vaccinations, allergies, anomalies, blood type, rh factor, etc. Availability and fast evaluation of these data are important in a case of emergency.

(c) The PDC may be used as personal key for communication security, e.g. containing, the owner's private signature key.

(d) The PDC may be used as a rechargeable credit card. The card issuer such as a bank "charges" or "loads" the card with a certain amount of money. With each use the owner withdraws a portion of this amount. After consumption of the total amount the card will be "recharged".

(e) The PDC may be used as a personal notebook and/or to store, for instance, frequently needed information such as telephone numbers.

A technical implementation of a PDC could be based on magnetic bubble memory chips. These chips would eliminate the above-mentioned shortcomings (A) and (B).

Also other read/write memories capable of storing data without a permanent energy supply may be used. Yet, the shortcoming (C), that is the problem of protecting the stored sensitive, confidential and/or secret data against unauthorized access and modification, still would remain.

In the prior art cryptographic principles [1-11], for instance for identity verification, are disclosed. Based on these cryptographic principles, symmetrical (the Data Encryption Standard or DES) and non-symmetrical systems (Public Key Cryptosystems) may be implemented. Symmetrical systems are described, for instance, in [1], whereas non-symmetrical systems are described, for instance, in [2-11].

One problem associated with presently known identity verification systems resides in the fact that the card reading terminal may be connected to a communication system which is unprotected from non-authorized individuals or intruders. Information contained in the card may be obtained by the intruder(s) via such a communication system. Obviously this should be prevented since sensitive or even secret data may be stored in the card. Another problem associated with conventional identity verification systems relates to information which remains stored in the terminal after a validation operation. This information may be read out by an intruder. Again, access to sensitive information should be prevented.

3. Literature

[1] National Bureau of Standards, Federal Information Processing Standard FIPS Publication 46, U.S. Department of Commerce, Washington, D.C. (Jan. 1977).

[2] M. E. Hellman, "The Mathematics of Public-Key Cryptography", Scientific American, Vol. 241, No. 2 (Aug. 1979).

[3] Rivest, Shamir, Adleman, "A Method for Obtaining Digital Signatures and Public-Key Cryptosystems", Communications of the ACM, Vol. 21, No. 2 (Feb. 78).

[4] Needham, R. M., Schroeder, M. D., "Using Encryption for Authentication in Large Networks of Computers", Communic. ACM 21,12 (Dec. 1978), 993-999.

[5] Rabin, M., "Digitalized Signatures", Foundations of Secure Computing, R. Demillo et al., Eds., Academic Press, New York 1978.

[6] Merkle, R. C., Hellman, M. E. "Hiding Information and Signatures in Trapdoor Knapsacks", IEEE Trans. Inf. Theory, Vol. IT-24, No. 5, Sept. 1978.

[7] Shamir, A., "A fast Signature Scheme", MIT/LCS/TM-107, July 1978.

[8] McEliece, R. J., DSN Progress Report 42-44, Jan./Feb. 1978.

[9] Lagger, H., Mueller-Schloer, C., Unterberger, H., "Sicherheitsaspekte in rechnergesteuerten Kommunikationssystemen", Elektronische Rechenanlagen, Oldenbourg Verlag Munich, Dec. 1980, p. 276-280.

[10] Diffie W., Hellman, M. E., "New Directions in Cryptography", IEEE Transactions on Information Theory, Vol. IT-22, No. 6, Nov. 1976, p. 644-654.

[11] Kolata, G. B., "New Codes Coming into Use", Science, Vol. 208, May 1980, p. 694-695.

SUMMARY OF THE INVENTION

Objects

It is an object of the invention to provide an apparatus for validation of a person presenting a data card, said apparatus being connected to an unprotected communication system and said card being nevertheless secure against intruders.

It is another object to provide an apparatus for yielding access to secret or sensitive data stored on a personal data card with protection against misuse of the card by unauthorized users.

It is still another object to provide an apparatus which contains a terminal having a card reader, whereby said terminal is connected to a communication system which may be unprotected against intruders.

It is still another object to provide an apparatus for validation of a personal data card which apparatus incorporates a terminal wherein no card information remains after a validation process.

It is still another object to provide an apparatus for validation of a personal data card which incorporates a terminal which does not contain a reference personal identification information on a permanent basis.

It is still another object to provide an apparatus for validation of a personal data card that contains secret or sensitive data in encrypted form and additionally reference personal identification information also in encrypted form.

It is still another object to provide a method for cryptographic identity verification providing for protection against intruders tapping the communication system used for transfer of messages.

It is also an object of this invention to provide a method for detection of a disconnection between a terminal and a communication system by performing a disconnection check.

It is still another object of this invention to provide a method for detection of a disconnection between any of a plurality of terminals and a communication system, without the predistribution of secret key information from said communication system to said terminals.

Summary

According to one aspect of this invention, an apparatus for identity verification using a data card is provided. In particular, the card is a personal data card. The apparatus grants protection against misuse of the data card by unauthorized users.

The apparatus contains a terminal and a security serVice station whcih are connected to each other by a communication system provided for transmitting digital data from the terminal to the security service station, and vice versa.

The terminal contains a first central processing unit having a first memory. This memory is provided for storage of a program, of a public network key, and of variables. The terminal also contains a card reader for reading data from the personal data card and for introducing these data into the first memory. The data stored on the card may include sensitive or even secret data. The terminal further contains an input device for introducing personal identification information, such as personal features or personal identification numbers, into the first memory. The terminal also contains a first crypto module which is connected to the first central processing unit. The first crypto module is adapted to encrypt and decrypt data received from the first memory under the control of the first central processing unit.

The security service station contains a second central processing unit having a second memory. This memory is provided for storage of a program, of a secret network key, and of variables. The station also contains a second crypto module which is connected to the second central processing unit. The second crypto module is adapted to encrypt and decrypt data received from the second memory under the control of the second central processing unit. The station further contains a comparator which is connected to the second central processing unit for comparing personal identification information transmitted from the terminal with reference personal identification information, also transmitted from the terminal.

According to another aspect of this invention, a method for cryptographic identity verification is provided. This method comprises the following steps:

(a) Reading card information from a personal data card and entering personal feature data into a terminal. The card information comprises reference feature data as well as a first key. The reference feature data and the first key are encrypted with a public network key thereby forming a first cryptogram.

(b) Generating a temporary key and a message number in the terminal.

(c) Encrypting the personal feature data, the first cryptogram contained in the card information, the message number and the temporary key with a public network key in the terminal. These data form a first message.

(d) Sending the first message to a security service station via a communication system.

(e) Decrypting the first message including the first cryptogram with a secret network key in the security service station. Thus the first key, the message number, the feature data, the reference feature data and the temporary key are obtained. The mentioned secret network key is correlated in a well-known manner to the public network key.

(f) Comparing the feature data and the reference feature data with each other in the security service station.

(g) Generating a modified message number by applying a publicly known function to the message number in the security service station.

(h) Encrypting the modified message number and the first key with the temporary key in the security service station. Thereby a second message is formed.

(i) Sending this second message back to the terminal via the communication system.

(j) Decrypting the second message with the temporary key in the terminal. Thereby the modified message number and the first key are obtained.

(k) Comparing the modified message number with a generated modified message number in the terminal. The generated modified message number is self-generated in the terminal by applying the publicly known function to the message number.

(l) Using the first key to decrypt the secret data.

The invention presents a solution to the problem of misuse protection of a lost data card. The invention uses personal feature extraction (or personal identification number entries) and verification (for instance, fingerprints or voice) in conjuction with cryptographic principles. Both cryptographic systems, that is the symmetrical (e.g. DES) one and non-symmetrical ones (Public Key Cryptosystems), may be applied.

The invention guarantees that personal data cards can be used only by their owners. No easily breakable "secret" memo codes (birthday, wedding date, etc.) as in today's systems are necessary. No user specific information remains in the terminal, assuring full user mobility. The security service station does not have to store user names and keys. The terminals can be kept inexpensive as the feature comparator is located in a central location

and hence can be shared by many terminals or subscribers.

The method according to the invention can be used in Personal Access Control Systems with possibly insecure lines between feature extractor and comparator.

The foregoing and other objects, features and advantages of the invention will be apparent from the following more particular description of preferred embodiments of the invention, as illustrated in the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. 1 is a diagram illustrating the prior art concept of Public Key Cryptography;

FIG. 2 is a diagram illustrating an apparatus containing various terminals and a security service station connected to an unprotected communication system, said apparatus undergoing a disconnection check;

FIG. 3 is a flowchart illustrating a disconnection check in an apparatus according to FIG. 2,

FIG. 4 illustrates a personal data card and the information contained therein,

FIG. 5 is an apparatus for identity verification according to the invention, and

FIG. 6, 6A and 6B are flowcharts illustrating a validation process in the apparatus according to FIG. 5.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

As the invention uses a pair of so-called "network keys", the concept of the network keys will first be explained. Thereafter, the logical operating sequence of a typical personal data card validation will be explained.

In communication networks with a large number of terminals or subscribers and frequently changing connections it is often advantageous to use Public Key Cryptosystems (PKC), see [2–11]. Central security equipment, if necessary, should be as simple as possible. Passive as well as active wire tapping has to be taken into account.

FIG. 1 schematically shows a PKC system according to the prior art, see [2]. Two stations or terminals A and B are connected to each other via a communication system CS. Ther terminals A and B contain PKC crypto modules MA and MB, respectively. These modules MA and MB operate with a predetermined encryption algorithm Ce and a predetermined decryption algorithm Cd, respectively. The terminal A is provided with a public key PK.A and a secret key SK.A. Similarly, the terminal B is provided with a public key PK.B and a secret key SK.B. In order to send a message MSG to the terminal B, the terminal A must get the public key PK.B of the terminal B. It then encrypts the message MSG under this key PK.B and sends the encrypted message or cryptogram {MSG}PK.B to the terminal B. In the terminal B the secret key SK.B is used for decryption. A passive intruder X connected to the communication system CS is not able to derive intelligible information from the cryptogram. But if the intruder X becomes active, i.e. if the intruder X inserts messages without being detected, countermeasures are necessary. These countermeasures comprise application of a public network key PK.N and a secret network key SK.N. as illustrated in FIG. 2 and as will be explained in greater detail subsequently.

In FIG. 2 the case of decentralized key storage is shown. After being asked by the terminal A, the terminal B transmits its public key PK.B to the terminal A. Passive wiretapping of the key PK.B is of no use for the intruder X as he cannot decrypt with it. However, if the intruder X replaces B's key PK.B by his own key PK.X, he is able to read A's encrypted messages by decryption with his secret key SK.X. For the terminal A there is no way to decide whether the received key came from the terminal B, as claimed, or from the intruder X.

The solution of this problem is based on the following assumptions:

(a) One or more so-called "Security Service Stations" SSS are installed in the Communication System CS. The Station SSS is located in a physically secure area, e.g. at a network node.

(b) The Station SSS uses a pair of the aforementioned "network keys" PK.N and SK.N. The key PK.N is made public. Although this key PK.N is not secret it must be assured that no one can shield any terminal from being supplied with the proper key PK.N. A simple way to achieve this is to publish PK.N in the newspaper.

(c) The Station SSS is able to carry out the following simple functions:

- receiving a short message;
- decrypting this message via a PKC algorithm using the secret network key SK.N;
- modifying the message by applying a publicly known function (e.g. by adding 1);
- encrypting the modified message and sending it back to the inquiring terminal;
- notifying a supervisor (man or machine) if there is any conflict.

It should be noted that SSS, the Security Service Station, does not need any extensive storage facilities for long messages, subscriber names or their public keys. According to FIG. 2, the Station SSS basically contains a PKC crypto module MS which communicates with the communication system CS.

During an active wiretapping by the intruder X one of the terminals A,B, . . . is necessarily disconnected from the network CS and SSS, at least during certain periods of time. In FIG. 2 the disconnection is designated by DI. The assumably disconnected terminal A could try to detect such a situation by sending messages to the network CS, SSS, i.e. the nearest node, but the answers could be simulated by the intruder X. The method illustrated in FIG. 3 can prevent this.

According to the flowchart of FIG. 3, the following steps will be taken:

1. The affected terminal (for example terminal A) sends at randomly selected times and as often as possible a short message C.1 to the Security Service Station SSS. This message C.1 includes the indication or address (A) of the sender A and his public key PK.A. As it has to be unique, it additionally contains a message number MNO consisting of the time, date and a random number. The combination (A, MNO, PK.A) then is encrypted under the public network key PK.N, that is:

$$C.1=\{A,MNO,PK.A\}\ PK.N \qquad (1)$$

The notation "{. . . } PK" means PKC encryption under the key PK. This message C.1 is transmitted to the Security Service Station SSS.

2. If there is no disconnection DI, the message C.1 is decrypted by the Station SSS with the key SK.N. Therefore, M.1=DECR.SK.N(C.1) will be obtained. The message number MNO is modified to MNO' by a

publicly known function f and along with the address (SSS) of the Station SSS encrypted under the public key PK.A of the terminal A. This results in a message C.2

$$C.2=\{SSS,MNO'\}\ PK.A \quad (2)$$

which is sent back to the terminal A. Here it is decrypted with the secret key SK.A of the terminal A.

In order to determine whether a disconnection DI prevails, a timer is started at the time t.1 when the first message C.1 is sent to the station SSS. The timer is stopped at the time t.2 when the second message C.2 is received by the terminal A. An evaluation is made whether the time difference (t.2−t.1) is within a predetermined time limit. If it is not, an alarm is caused. If it is, the determination is made whether f(MNO) as evaluated in terminal A equals MNO' as received from Station SSS. If these data are not equal, an alarm is caused.

One could think of the following attempts to breach this security system:

1. The intruder X tries to simulate the answer of the Station SSS. This is impossible as the intruder X cannot decrypt the message C.1 and properly modify the number MNO.

2. The intruder X receives the message C.1 and hands it without change via another line to the station SSS to have it validated.

But the station SSS tries to send back the answer to the indicated sender's physical address and therefore necessarily notices that the terminal A has already built up a connection to another party (the intruder X is interested in intercepting only during terminal A's connection periods). Because of the resulting conflict situation an alarm call is issued by the Station SSS to a supervisor system.

To reduce the probability of detection the intruder X must keep the time of interference as short as possible. On the other hand, the terminals A,B, . . . should send their messages as often as possible in order to increase this probability of detection.

With reference to FIGS. 4–6 the protocol for a validation of a personal data card (PDC) will now be explained.

According to FIG. 4, a personal data card 2 contains sensitive and/or secret information. The data stored on a PDC must not be disclosed to an unauthorized person nor must it be possible to change these data without authorization and without detection. The information on the personal data card 2 has the following structure: it contains the name of the user USER NAME, the public key of the user PK.USER, and a public network key PK.N. It is again assumed that the public network key PK.N has been published. The card 2 further contains a reference feature REFERENCE FEATURE, and a key of a symmetrical cryptographic system, especially a DES-KEY. If a personal identification number (PIN) method is used, the REFERENCE FEATURE would be replaced on the card 2 by the PIN. It will be noted that the REFERENCE FEATURE as well as the DES-KEY are encrypted with the public network key PK.N. Subsequently, a PKC encryption will be denoted {. . . } whereas a DES encryption will be denoted <. . . >. Finally, the card 2 contains SECRET DATA which has to be protected. These SECRET DATA are encrypted with the DES-KEY. Thus, the card 2 contains a non-symmetrical cryptogram as well as a symmetrical cryptogram.

In FIG. 5, an apparatus for identity verification using a data card 2 is illustrated. The apparatus is designed such that it provides protection against misuse of the card 2 by unauthorized users.

The apparatus contains various terminals 4A, 4B, . . . which are connected to an unprotected communication system 6. This communication system 6 may be, for instance, a telephone or a broadcasting net. It may also be a packet switching network. Such communication system 6 is easily accessable to intruders. To the communication system 6 is also connected a security service station 8. The individual terminals 4A, 4B, . . . may all have the same design. Therefore, only the terminal 4A will be considered more closely.

To provide an unforgeable link between the card owner and the card 2, personal identification information is introduced into the terminal 4A. The personal feature is symbolized by the card owner 10. The personal verification may be based on voice or fingerprint recognition. However, in some instances, it may be sufficient that the card owner enters his personal identification number PIN via a keyboard instead. Unfortunately the personal features extracted from the owner 10 cannot be used directly for generating cryptographic keys as the resulting bit patterns vary to a certain degree. The crypto keys, on the other hand, must be reproduceable bit by bit. In order to overcome this problem, the security service station 8 is equipped with a personal feature/reference feature comparator, as will be explained later. The security service station 8 uses, as mentioned earlier, a pair of network keys, PK.N and SK.N. Ther terminal 4A is equipped with a central processing unit 12 with which is associated a memory 14. Instead of the central processing unit 12 and a separate memory 14, a microcomputer may be used which already contains a memory. The central processing unit 12 preferably may be a microprocessor. The memory 14 is used for storage of a program, of the public network key PK.N, and of variables.

A card reader 16 is used for reading the information from the personal data card 2. The card reader 16 is connected to the central processing unit 12. The card data are introduced into the memory 14 via the central processing unit 12. A feature extractor 18 is provided for extracting specific features of the card owner 10 into the memory 14. The feature extractor 18 has an input device such as a fingerprint sensor which has to be used by the card owner 10 in a verification process. The feature extractor 18 is also connected to the first central processing unit 12.

A very important unit in the terminal 4A is a crypto module 20. The crypto module 20 is also connected to the central processing unit 12. Preferably, the crypto module 20 may comprise two units, namely a DES crypto unit and a PKC crypto unit. The PKC unit specifically may comprise a chip that works according to the so-called RSA method which is known in the art from reference [3]. Generally it has to be mentioned that the crypto module 20 should be able to handle DES as well as PKC algorithms.*1 The crypto module 20 is adapted to encrypt and decrypt data received from the memory 14 under the control of the central processing unit 12.

*1 However, a symmetrical system (e.g. DES) is not necessary A PKC algorithm could be used it its place without compromising the security of the system. The reason for using symmetrical cryptoalgorithms is their higher speed.

Associated with the central processing unit 12 is a time generator or clock 22. This time generator is used to determine the time period which has elapsed between

sending a message and receiving a response message, as will be explained later. The time generator is also used to determine the time and date included in the message number MNO. A keyboard 24 provides access to the unit 12 from outside. A display device 26 may be associated with the keyboard 22. A random number generator 28 is also connected to the central processing unit 12. This generator is used for generating a temporary key.*2 The central processing unit 12 is connected to the communication system 6 via a communication interface 30.

*2 and a random number to be included in the message number MNO.

It will be noted that the design of the security service station 8 is similar to that of the terminal 4A. The security service station 8 also contains a central processing unit 32 which has a memory 34. The memory 34 is used for storage of a program, of a secret network key SK.N, and of variables.

A crypto module 36 is connected to the central processing unit 32. This crypto module 36 is used to encrypt and decrypt data received from the second memory 34 under the control of the central processing unit 32. The crypto module 36 should have the same design as the crypto module 20 of the terminal 4A.

The central processing unit 32 works together with a comparator 38 which is connected thereto. This comparator 38 is used for compairing transmitted personal identification information with reference personal identification information which is also transmitted via the communication system 6.

In the security service station 8 there may also be provided a time generator or clock 40. This time generator 40 may also be used in connection with the determination of the time period elapsed between emitting and receiving a message. The central processing unit 32 is connected to the communication system 6 through a communication interface 42.

The crypto module 20 is preferably designed such that it works as a public key system using a public netowrk key PK.N in its encrypting operation mode and as symmetrical or DES system using a symmetrical or DES key and additionally a temporary symmetrical or DES key in its decrypting operation mode. The crypto module 36 may preferably be designed such that it works as a public key system using a secret network key SK.N in its decrypting operation mode and as a symmetrical or DES system using the temporary symmetrical or DES key in its encrypting operation mode. As conventional, the secret network key SK.N is correlated to the public network key PK.N.

In absence of a card user 10 the terminals 4A, 4B . . . are "empty", that is no user keys or reference features are stored. After insertion of the personal data card 2, the respective module 4A or 4B is dedicated to the specific user 10 if the validation procedure has been carried out successfully.

In FIG. 6 a flowchart is illustrated indicating how a validation process may be performed. On the left side of FIG. 6 the actions of the terminal are registers, whereas on the right side of FIG. 6 the actions of the security service station 8 are described.

According to FIG. 6 a PDC validation process is started by inserting the personal data card 2 into the card reader 16 and by activating the sensor of the feature extractor 18. Instead of a personal feature, also a personal identification number may be entered into the terminal 4A. The card reader 16 will read the PDC information, and the feature extractor 18 will extract personal feature(s) from the card user 10. The information read by the card reader 16 may be preferably comprise all information contained in the card 2, as shown in FIG. 4. Subsequently the central processing unit 12 generates a temporary DES key at random which is designated as DES.TEMP. The random number genrator 28 is used for this prupose. There is also generated a message number MNO. Now the following data are present in the terminal 4A: the address T of the terminal 4A which sends the message, the FEATURE extracted by the feature extractor 18, the cryptogram (REFERENCE FEATURE, DES key) PK.N obtained from the personal data card 2, the message number MNO, and the temporary DES key DES.TEMP. These data are now encrypted with the public network key PK.N to form a first message C.1.

The first message C.1 is sent to the security service station 8 via the communication system 6. At this point the time from time generator or timer 22 is read into the memory forming a first time T1.

The first message C.1 is decrypted by the security service station 8 with the secret network key SK.N. This is done by the crypto module 36. As a result all data contained in the curved (. . .) parentheses of the message C.1 are now available in the station 8. Subsequently it is checked whether the received message number MNO is situated in a predetermined time window. If this is the case, the message number MNO is valid.

Now the inner cryptogram of the first message C.1, that is the cryptogram {REFERENCE FEATURE, DES key} PK.N, is decrypted with the secret network key SK.N. Thus, the REFERENCE FEATURE and the DES key will be obtained as clear data.

The next step is to compare the transmitted FEATURE with the transmitted REFERENCE FEATURE. The comparison is performed by the comparator 38. Such comparators are, for instance, known in the conventional PACS (personal access control) methods.

If the comparison is positive, i.e. the features correspond within predefined limits a modified message number MNO' is generated. This modified message number MNO' is obtained from the transmitted message number MNO by applying a publicly known function F.

As a next step, the following data are encrypted with the temporary DES key DES.TEMP: the address SSS of the security service station 8, the modified message number MNO', and the DES key. The encryption results in a second message C.2. This second message C.2 is sent to the terminal.

Here, the received second message C.2 is decrypted with the temporary DES key DES.TEMP. On arrival of the second message C.2 the time generator 22 is read at a time T.2. If the time difference (T.2−T.1) is smaller than a predetermined time limit, then a determination is made whether the modified message number MNO' is okay. For this purpose, in the station 8 the function F is applied to the message number MNO previously sent out. Thus, the modified number F(MNO) is obtained. If this number F(MNO) equals the received modified message number MNO', that is if the check is positive, the SECRET DATA of the card 2 are decrypted by the aid of the DES key. Then the operation is continued using the required SECRET DATA.

Finally, the DES key, all information read from the personal data card 2 and the personal FEATURE are erased from the memory 14 of the terminal 4A, and the operation is stopped.

In order to satisfy the demands of Data Security Laws the SECRET DATA could be structured by additional encryptions assuring that only certain parts of it may be accessed at a time.

The advantages of the apparatus illustrated in FIG. 5 and of the method shown in FIG. 6 are as follows:

(a) The personal data card (PDC) may contain data which have to be pretected against misuse. These data are effectively protected since access is only permitted after a positive identity check. Thus, it is guaranteed that personal data cards can only be used by their owners.

(b) The terminal itself does not need to contain a comparator in order to determine whether the authorized user has inserted the card into the card reader and additionally supplied a personal feature or a personal identification number (PIN). In the present invention such a comparator is incorporated into the security service station. It can be shared by a large number of terminals. As a result, a relatively inexpensive system for cryptographic identity verification is obtained.

(c) The security service station does not have to store any data of the user, such as user names and keys, since these data are stored in an encrypted form on the personal data card. Therefore all changes of the user data will be made on the card itself. It is not necessary to update such data in the security service station.

(d) Another advantage resides in the fact that any security service station to which is connected the terminal in use can perform the validation as long as this station is provided with the secret network key (SK.N). That means that a single personal data card can be used in connection with separate security stations without the necessity of any communication about the personal features between these stations. This feature grants wide mobility for the user. In other words, the user can utilize his or her card at various locations.

(e) In the apparatus and method according to the invention a non-ambiguous identity verification is possible even though the connections between the terminal and the communication system including the security service station may be unprotected.

(f) As no information remains in the terminal again wide mobility is assured for the user.

While the forms of the cryptographic apparatus and method herein described constitute preferred embodiments of the invention, it is to be understood that the invention is not limited to these precise forms of assembly, and that a variety of changes may be made therein without departing from the scope of the invention.

What is claimed is:

1. An apparatus for identity verification using a data card with protection against misuse of said card by unauthorized users, comprising in combination:

(a) a terminal containing

(a1) a first central processing unit having a first memory for storage of a program, of a public network key, and of variables;

(a2) a card reader for reading data from said personal data card and for introducing said data into said first memory, said data including sensitive data;

(a3) input means for introducing personal identification information into said first memory;

(a4) a first crypto module connected to said first centeral processing unit, said first module being adapted to encrypt and decrypt data received from said first memory under the control of said first central processing unit;

(b) a security service station containing

(b1) a second central processing unit having a second memory for storage of a program, of a secret network key, and of variables;

(b2) a second crypto module connected to said second central processing unit, said second crypto module being adapted to encrypt and decrypt data received from said second memory under the control of said second central processing unit;

(b3) a comparator connected to said second central processing unit for comparing transmitted personal identification information with transmitted reference personal identification information, and

(c) a communication system connecting said terminal to said security service station, said communication system transmitting digital data from said terminal to said security service station, and vice versa, including said personal identification information and said reference personal identification information.

2. The apparatus according to claim 1, wherein said first crypto module is such that it works as a public key system using a public network key in its encrypting mode,*3 and wherein said second crypto module is such that it works as a public key system using a secret network key in its decrypting mode and as a symmetrical system using said temporary second key in its encrypting mode, whereby said secret network key is correlated to said public network key.

*3 and as a symmetrical system using a first key and a temporary second key in its decrypting mode.

3. The apparatus according to claim 2, wherein said symmetrical system is the DES system, wherein said first key is a DES key, and wherein said temporary second key is a temporary DES key.

4. The apparatus according to claim 2, further comprising a random number generator for generating said temporary second key, said temporary second key being transmitted in an encrypted form to said security service station.

5. A method for cryptographic identity verification, comprising the following steps:

(a) reading card information from a personal data card and entering personal feature data into a terminal, said card information comprising reference feature data as well as a first key, said reference feature data and said first key both being encrypted with a public network key, thereby forming a first cryptogram;

(b) generating a temporary key and a message number in said terminal;

(c) encrypting said personal feature data, said first cryptogram contained in said card information, said message number and said temporary key with a public key in said terminal, thereby forming a first message;

(d) sending said first message to a security service station via a communication system;

(e) decrypting said first message including said first cryptogram with a secret network key in said security service station, thus obtaining said first key, said message number, said feature data, said reference feature data, and said temporary key,

whereby said secret network key is correlated to said public network key;

(f) comparing said feature data and said reference feature data with each other in said security service station;

(g) generating a modified message number by applying a publicly known function to said message number in said security service station;

(h) encrypting said modified message number and said first key with said temporary key in said security service station, thereby forming a second message;

(i) sending said second message to said terminal via said communication system;

(j) decrypting said second message with said temporary key in said terminal, thereby obtaining said modified message number; and

(k) comparing said modified message number with a generated modified message number in said terminal, said generated modified message number being self-generated in said terminal by applying said publicly known function to said message number.

6. A method for detection of a disconnection between a terminal and a communication system, said terminal having a first crypto module which works as a public crypto system and which is adapted to encrypt thereby using a public network key and which is adapted to decrypt thereby using a secret key of its own, said terminal providing a public key of its own and being provided with a predetermined function, a terminal address, and a station address, comprising the following steps:

(a) forming a first message in said terminal, said first message comprising

(a1) said address of said terminal

(a2) a unique message number, and

(a3) said public key of said terminal;

(b) encrypting said first message under said public network key,

(c) sending said encrypted first message to a security service station, said station address being assigned to said station;

(d) decrypting said first message with a secret network key in said security service station, said secret network key being correlated to said public network key unambiquously, thereby identifying said address, said unique message number and said public key of said terminal,

(e) modifying said identified message number by using said predetermined function, thereby obtaining a modified message number,

(f) forming a second message in said security service station, said second message comprising;

(f1) said address of said security service station and

(f2) said modified message number,

(g) encrypting said second message under said public key of said terminal;

(h) sending said encrypted second message to said terminal, thereby using said address of said terminal for addressing said terminal;

(i) decrypting said encrypted second message in said terminal with said secret key of said terminal, thereby identifying an address and a modified message number,

(j) modifying said unique message number according to said predetermined function; and

(k) comparing said identified modified message number with said modified unique message number, thereby authenticating said security service station and confirming the presence of a connection between said terminal and said communication system.

7. The method according to claim 6, wherein a time stamping method is applied for determining whether a predetermined time has been exceeded between sending said encrypted first message and receiving said decrypted second message.

8. The method according to claim 7, wherein a time clock is started when said encrypted first message is sent to said station, and wherein said time clock is stopped when said second message has been decrypted.

* * * * *

Boston Public Library

H

United States District Court,
E.D. Pennsylvania.

Ronald A. KATZ, Technology Licensing, L.P., and MCI Telecommunications Corporation, Plaintiffs,
v.
AT & T CORPORATION, et al., Defendants.

No. CIV. A. 97-4453.

Aug. 26, 1999.

Owner of patents for interactive voice response system sued telephone company for infringement. The District Court, Lowell A. Reed, Jr., Senior District Judge, construed claim language.

Claims construed.

Retrieved from DocketAlarm.com

West Headnotes

[1] **Patents** 314(5)
291k314(5) Most Cited Cases

Construction of patent claims is exclusively within province of court to determine as matter of law.

[2] **Patents** 159
291k159 Most Cited Cases

[2] **Patents** 165(1)
291k165(1) Most Cited Cases

[2] **Patents** 167(1)
291k167(1) Most Cited Cases

[2] **Patents** 168(2.1)
291k168(2.1) Most Cited Cases

In construing patent claim, court should consider claim language, specification, and, if offered, prosecution history, which are collectively considered intrinsic evidence of meaning of claim terms; under some circumstances, court may also consult evidence extrinsic to patent, such as technical dictionaries or expert testimony as to how those skilled in relevant art under consideration would interpret claims.

[3] **Patents** 161
291k161 Most Cited Cases

Absent special and particular definition created by patent applicant, term in patent claim is construed to mean what person of ordinary skill in art at time of invention would have understood term to mean.

[4] **Patents** 157(1)
291k157(1) Most Cited Cases

Unless otherwise compelled, court should give full effect to ordinary meaning of patent claim terms, even if terms are broad.

[5] **Patents** 162
291k162 Most Cited Cases

[5] **Patents** 167(1)
291k167(1) Most Cited Cases

[5] **Patents** 168(2.1)
291k168(2.1) Most Cited Cases

Once court construing patent terms has determined ordinary meaning of the claim term, it must also consider specification and prosecution history to determine if patentee used term in manner inconsistent with its ordinary meaning.

[6] **Patents** 167(1.1)
291k167(1.1) Most Cited Cases

One may not read limitation into patent claim from written description, but one may look to written description to define term already in claim limitation, for claim must be read in view of specification of which it is part.

[7] **Patents** 167(1)
291k167(1) Most Cited Cases

While additional limitations may not be imported into patent claim from specification, court may construe limitation specifically recited in claim in light of specification.

[8] **Patents** 167(1.1)
291k167(1.1) Most Cited Cases

In order to inject definition into patent claim from written description, claim must explicitly contain term in need of definition.

[9] **Patents** 167(1.1)
291k167(1.1) Most Cited Cases

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works

Patent claim term should not be narrowed by content of specification unless language of claim invites reference to those sources.

[10] Patents 162
291k162 Most Cited Cases

Patent claim term may be given definition other than its ordinary meaning if patentee chooses to be his or her own lexicographer by explicitly setting forth definition in specification, or if terms chosen by patentee so deprive claim of clarity that there is no means by which scope of claim may be ascertained from language used.

[11] Patents 168(2.1)
291k168(2.1) Most Cited Cases

Prosecution history cannot enlarge, diminish, or vary limitations in patent claims.

[12] Patents 168(2.1)
291k168(2.1) Most Cited Cases

Court construing patent claim may consider prior art cited in prosecution history, which may contain clues as to what claim does not cover.

[13] Patents 168(2.1)
291k168(2.1) Most Cited Cases

If patent applicant takes position before Patent and Trademark Office, such that competitor would reasonably believe that applicant had surrendered relevant subject matter, applicant may be barred from asserting inconsistent position when issued patent is subsequently construed.

[14] Patents 168(2.1)
291k168(2.1) Most Cited Cases

Unless altering claim language to escape examiner rejection, patent applicant only limits claims during prosecution by clearly disavowing claim coverage, that is, by making statement that concedes or disclaims coverage of claims at issue based on piece of prior art.

[15] Patents 159
291k159 Most Cited Cases

Extrinsic evidence is to be used for court's understanding of patent, not for purpose of varying or contradicting claim terms.

[16] Patents 159
291k159 Most Cited Cases

Extrinsic evidence may be consulted if court is not familiar with terminology of art in which patent is written, but it should not be consulted to clarify ambiguity in claim terms.

[17] Patents 159
291k159 Most Cited Cases

Where patent documents are unambiguous, expert testimony regarding meaning of claim is entitled to no weight.

[18] Patents 101(8)
291k101(8) Most Cited Cases

Presumption that use of term "means" in patent claim invokes means plus function limitations may be rebutted if claim recites no function which corresponds, or if claim recites function but also recites sufficient structure or material for performing claimed function. 35 U.S.C.A. § 112.

[19] Patents 101(8)
291k101(8) Most Cited Cases

Structural term in patent claim need not connote precise physical structure to those of ordinary skill in art in order to avoid means-plus-function analysis, so long as it conveys variety of structures that are referred to by that term. 35 U.S.C.A. § 112.

[20] Patents 226.7
291k226.7 Most Cited Cases

If structure is defined in patent specification in way unrelated to recited function in means-plus-function clause in claim, those additional aspects of structure should not be read as limiting scope of means clause. 35 U.S.C.A. § 112.

[21] Patents 101(8)
291k101(8) Most Cited Cases

In construing means plus function claims, generally a court should not import function of working device or preferred embodiment into claims as part of "means" if such function is not part of function recited in claims. 35 U.S.C.A. § 112.

[22] Patents 101(2)
291k101(2) Most Cited Cases

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works

"Communication facility," called for in patent claims for interactive voice response system, was that part of telephone network that enabled caller to connect to patented system; term did not encompass elements or processes of entire public switched telephone network, or require that system be operated only outside network.

[23] Patents 101(2)
291k101(2) Most Cited Cases

"Interface structure" for analysis control system, called for in patent claims for interactive voice response system, referred to hardware and software required to connect processors upon which system was running to communication facility such that information from facility and remote terminals could be provided to and received by system; in context, phrase also included means to perform specific function of providing caller data signals representative of data developed at remote terminals, and means to perform specific function of receiving calling number identification data.

[24] Patents 101(8)
291k101(8) Most Cited Cases

Critical factor in determining whether term in patent claim limitation which does not invoke "means for" language is subject to means-plus-function analysis despite contrary presumption is whether term brings to mind set of structures to those of ordinary skill in art, and not whether term is written in functional language. 35 U.S.C.A. § 112.

[25] Patents 101(2)
291k101(2) Most Cited Cases

"Means to provide caller data signals" and "means to receive calling number identification data," called for in patent claims for interactive voice response system, were limited to disclosed structures which specifically performed those functions. 35 U.S.C.A. § 112.

[26] Patents 101(2)
291k101(2) Most Cited Cases

"Voice generator" for analysis control system, called for in patent claims for interactive voice response system, meant device for generating vocal instructions or prompts to individual callers at remote terminals.

[27] Patents 101(2)
291k101(2) Most Cited Cases

"Record structure" for analysis control system, called for in patent claims for interactive voice response system, referred to means for entering or making use of files, but did not delineate or restrict types of functions that could be performed on files once they were accessed.

[28] Patents 101(2)
291k101(2) Most Cited Cases

"Qualification structure" for analysis control system, called for in patent claims for interactive voice response system, was limited to disclosed structures which performed function of controlling access to system by individual callers. 35 U.S.C.A. § 112.

[29] Patents 101(2)
291k101(2) Most Cited Cases

"Means for selecting," called for in patent claims for interactive voice response system, was limited to disclosed structures which specifically performed function of selecting format based on called number. 35 U.S.C.A. § 112.

[30] Patents 101(2)
291k101(2) Most Cited Cases

"Switching structure" for analysis control system, called for in patent claims for interactive voice response system, meant device, including hardware and associated software, that could switch or route telephone calls or signals from one location or connection to another.

[31] Patents 101(2)
291k101(2) Most Cited Cases

"Record testing structure" for analysis control system, called for in patent claims for interactive voice response system, was limited to disclosed structures which specifically performed function of receiving and testing signals against stored data. 35 U.S.C.A. § 112.

[32] Patents 101(2)
291k101(2) Most Cited Cases

Term "processing," called for in patent claims for interactive voice response system, meant manipulation of data which performed some operation or sequence of operations on data.

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works

[33] Patents 101(2)
291k101(2) Most Cited Cases

Term "format," called for in patent claims for interactive voice response system, meant computer program that set forth content and sequence of steps to gather information from and convey information to callers through pre-recorded voice prompts and messages.

[34] Patents 101(2)
291k101(2) Most Cited Cases

"Multiple formats" or "plurality of formats," called for in patent claims for interactive voice response system, meant more than one format; terms did not include subroutines or branching within single format.

[35] Patents 101(2)
291k101(2) Most Cited Cases

"Remote terminals," called for in patent claims for interactive voice response system, meant devices or instruments for connecting callers to telephone network for voice and digital communication, including, but not limited to, conventional telephones.

[36] Patents 101(2)
291k101(2) Most Cited Cases

"DNIS" and "called number identification data," called for in patent claims for interactive voice response system, were synonymous, and meant signal or data that identified number called.

[37] Patents 101(2)
291k101(2) Most Cited Cases

"ANI" and "calling number identification data," called for in patent claims for interactive voice response system, were synonymous, and meant signal that identified calling number, i.e., number from which call originated.

[38] Patents 101(2)
291k101(2) Most Cited Cases

"In-band" or "out-of-band" signaling, called for in patent claims for interactive voice response system, did not require or exclude any particular manner of transmission or type of signaling.

[39] Patents 101(2)
291k101(2) Most Cited Cases

"Consumable participation key," called for in patent claims for interactive voice response system, meant number or word that allowed caller access to service or part of service predefined limited number of times and which could not be refreshed or recharged.

[40] Patents 101(2)
291k101(2) Most Cited Cases

"Limit on use," called for in patent claims for interactive voice response system, meant control that limited caller's access to service based on some predetermined method of measuring level of use; term was not restricted to specific method of measuring use, such as limited number of accesses into system.

[41] Patents 101(2)
291k101(2) Most Cited Cases

"Products carrying participation numbers," called for in patent claims for interactive voice response system, meant physical items sold or exchanged in commercial setting which carried number allowing participation in system.

[42] Patents 101(2)
291k101(2) Most Cited Cases

"Accounting data," called for in patent claims for interactive voice response system, meant information relating to computation of data.

[43] Patents 101(2)
291k101(2) Most Cited Cases

"Operations of an interface," referred to in patent claims for interactive voice response system, meant processes, activities, or functions of interactive connection between processors upon which system was running, communication facility, and callers; phrase did not require that system be running one of the formats disclosed in the specifications.

[44] Patents 101(2)
291k101(2) Most Cited Cases

"Answer data," called for in patent claims for interactive voice response system, meant responses from callers to vocal questions or prompts.

[45] Patents 101(2)
291k101(2) Most Cited Cases

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works

"Testing the selected format," called for in patent claims for interactive voice response system, meant method by which it was determined whether any conditions associated with format that had been selected by call data signals were satisfied.

[46] **Patents** 101(11)
291k101(11) Most Cited Cases

Where plain meaning of method claim language indicates sequential nature to claim steps and specification does not suggest otherwise, steps must be performed in order written in claim.

[47] **Patents** 101(11)
291k101(11) Most Cited Cases

Basic steps listed in method claims of patents for interactive voice response system, i.e., receiving call data signals, selecting format, testing selected format, and conditionally interfacing, had to be performed sequentially; additional steps listed in claims, however, did not have to be performed in any particular order.

[48] **Patents** 101(2)
291k101(2) Most Cited Cases

"Call data signals," called for in testing step of patent claims for interactive voice response system, referred to number from which call originated.

[49] **Patents** 101(2)
291k101(2) Most Cited Cases

"Conditionally interfacing," referred to in patent claims for interactive voice response system, meant connecting call to selected format once any conditions associated with that format had been satisfied.

[50] **Patents** 101(2)
291k101(2) Most Cited Cases

"Live Operator Attended Terminals," called for in patent claims for interactive voice response system, did not require that prompts displayed at operating stations be identical to vocal prompts used in automated formats.

[51] **Patents** 101(2)
291k101(2) Most Cited Cases

"Selecting a processing format" step, referred to in patent claims for interactive voice response system, was controlled solely by called number.

[52] **Patents** 101(2)
291k101(2) Most Cited Cases

"Demographic conditions," referred to in patent claim for interactive voice response system, meant conditions used to limit call based on caller's geographic area.

[53] **Patents** 101(2)
291k101(2) Most Cited Cases

"Means for directly forwarding," called for in patent claim for interactive voice response system, was limited to disclosed structures which specifically performed function of directly forwarding call from remote terminal to live operator-attended terminal when remote terminal from which caller was calling was not technically capable of digitally providing data. 35 U.S.C.A. § 112.

[54] **Patents** 101(2)
291k101(2) Most Cited Cases

"First response unit means," called for in patent claims for interactive voice response system, referred to audio response units.

[55] **Patents** 101(2)
291k101(2) Most Cited Cases

"Qualification means," called for in patent claim for interactive voice response system, was limited to disclosed structures which specifically performed function preliminarily qualifying callers from remote terminals for connection to interface processors, and software required to perform said qualifying. 35 U.S.C.A. § 112.

[56] **Patents** 101(2)
291k101(2) Most Cited Cases

"Second response unit means for receiving calls in a second call mode," called for in patent claim for interactive voice response system, meant call mode, such as 900 call mode or area code mode, other than 800 call mode.

[57] **Patents** 165(4)
291k165(4) Most Cited Cases

Whether preamble imposes additional limitation on patent claim depends on whether it is structural or

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works

mere statement of purpose or use of invention.

[58] Patents 101(2)
291k101(2) Most Cited Cases

"Means for processing calls in an interface format," called for in patent claim for interactive voice response system, was limited to disclosed structures which specifically performed that function. 35 U.S.C.A. § 112.

[59] Patents 101(2)
291k101(2) Most Cited Cases

"Memory means for storing caller cues and use indications," called for in patent claim for interactive voice response system, meant computer hardware that stored questions or prompts which were given to caller.

[60] Patents 101(2)
291k101(2) Most Cited Cases

"Means for selecting a current caller cue," called for in patent claim for interactive voice response system, was limited to disclosed structures and associated software which specifically performed function of selecting current caller cue from memory under control of identification signals and use indications. 35 U.S.C.A. § 112.

Patents 328(2)
291k328(2) Most Cited Cases

4,930,150, 5,128,984, 5,255,309, 5,351,285, 5,561,707, 5,684,863. Cited.

***588** Robert T. Haslam, Sarah E. Mitchell, Heller Ehrman, White & McAufliffe, LLP, Palo Alto, CA, Carl S. Nadler, Jenner & Block, Washington, DC, Bradford P. Lyerla, Ryndak & Lyerla, Chicago IL, for Plaintiffs.

Matthew J. Siembieda, Timothy D. Katsiff, Blank Rome Comisky & McCauley, Philadelphia, PA, Thomas D. Rein, Douglas I. Lewis, Russell E. Cass, Lisa A. Schneider, Andrew J. Wu, Sidley & Austin, Chicago, IL, Mark D. Wegener, Matthew J. Moore, Howrey & Simon, Washington, DC, Fred T. Magaziner, Martin J. Black, Abbe F. Fletman, Wolf, Block, Schorr and Soliscohen, LLP, Philadelphia, PA, for Defendants.

CONCLUSIONS OF LAW REGARDING PATENT CLAIM CONSTRUCTION

LOWELL A. REED, Jr., Senior District Judge.

Ronald A. Katz ("Katz") is the inventor in a large body of patents dealing with telephonic interactive voice applications. The plaintiffs, Ronald A. Katz Technology Licencing, L.P. and MCI Telecommunications Corporation, filed this patent infringement suit against AT & T Corporation, AT & T Universal Card Services Corporation, and AT & T American Transtech, Inc., alleging that the defendants are infringing a number of Katz's patents. In total, over 400 patent claims are at issue in this lawsuit. Because of the complexity and size of the case, the Court ordered that the parties designate a set of approximately seventeen claims to be construed at a *Markman* hearing. The plaintiffs designated twenty claims, including Claims 33, 44, 93, 104, 117, and 192 of the 5,561,707 patent (the '707 patent), Claims ***589** 49, 50, 65, 79, 171, and 190 of the 5,684,863 patent (the '863 patent), Claim 51 of the 5,255,309 patent (the '309 patent), Claim 15 of the 4,930,150 patent (the '150 patent), Claims 17, 20, 24, and 77 of the 5,351,285 patent (the '285 patent), and Claims 4 and 15 of the 5,128,984 patent (the '984 patent).

A *Markman* hearing was held from through June 4, 1999, in which the parties presented expert testimony and oral argument as to the proper construction of the disputed claim language in the twenty claims at issue. The parties also submitted a series of briefs and proposed claim constructions to the Court, all of which were considered by this Court in making the claim constructions that follow. On each claim term to be construed, the parties have submitted many arguments and have pointed to many portions of the intrinsic and extrinsic record in their briefs, in their proposed claim constructions, and in their oral presentations. While the Court has considered all of the arguments and citations of the parties, I may not reiterate all of them in full for each claim term.

I. THE LAW OF PATENT CLAIM CONSTRUCTION

In general, a patent must describe the scope of the patentee's invention so as to "secure to [the patentee] all to which he is entitled, [and] to apprise the public of what is still open to them." *Markman v. Westview Instruments, Inc.*, 517 U.S. 370, 373, 116 S.Ct. 1384, 134 L.Ed.2d 577 (1996) (internal quotation omitted). This is accomplished through the specification of the patent, which should describe the invention in clear terms so that a person in the art of the patent may make and use the invention, and the claims of the patent, which should "particularly poin[t] out and

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works

distinctly clai[m] the subject matter which the applicant regards as his invention." 35 U.S.C. § 112.

[1][2] In *Markman v. Westview Instruments, Inc.*, the Supreme Court, affirming the Court of Appeals for the Federal Circuit, held that construction of patent claims is exclusively within the province of the court to determine as a matter of law. 517 U.S. at 372, 116 S.Ct. 1384. To complete the task of claim construction, a court may draw on the canons of construction that can be sifted from the decisions of the Court of Appeals for the Federal Circuit spanning before *Markman* and beyond. In construing the claims of a patent, a court should consider the claim language, the specification, and, if offered, the prosecution history, which are collectively considered intrinsic evidence of the meaning of the claim terms. *See Markman v. Westview Instruments, Inc.*, 52 F.3d 967, 979 (Fed.Cir.1995). As the public record before the Patent and Trademark Office ("PTO") upon which the public is entitled to rely, the intrinsic evidence is the most important source for determining the meaning of claim terms. *See Vitronics Corporation v. Conceptronic, Inc.*, 90 F.3d 1576, 1582, 1583 (Fed.Cir.1996). Under some circumstances, a court may also consult evidence extrinsic to the patent, such as technical dictionaries or expert testimony as to how those skilled in the relevant art under consideration would interpret the claims. *Id.*

A. CLAIM LANGUAGE

[3] Because the scope of the rights conveyed to the patentee is defined by the claims, claim construction "begins and ends in all cases with the actual words of the claim." *Renishaw PLC v. Marposs Societa' per Azioni*, 158 F.3d 1243, 1248 (Fed.Cir.1998). In construing the terms of a claim, "the focus is on the objective test of what one of ordinary skill in the art at the time of the invention would have understood the term to mean." *Markman*, 52 F.3d at 987. "Absent a special and particular definition created by the patent applicant, terms in a claim are to be given their ordinary and accustomed meaning." *Renishaw*, 158 F.3d at 1249.

***590** [4] Unless otherwise compelled, a court should give full effect to the ordinary meaning of claim terms, even if the terms are broad. *See Johnson Worldwide Associates, Inc. v. Zebco Corporation*, 175 F.3d 985, 989 (Fed.Cir.1999). "General descriptive terms will ordinarily by given their full meaning; modifiers will not be added to broad terms standing alone." *Id.*

[5] The specification, the prosecution history, and in some situations the extrinsic evidence may confirm the ordinary meaning of the claim terms or may provide a special meaning for the claim terms. *See Renishaw*, 158 F.3d at 1248. Thus, once a court has determined the ordinary meaning of the claim terms, it must also consider the specification and prosecution history to determine if the patentee used any terms in a manner inconsistent with their ordinary meaning. *See Vitronics*, 90 F.3d at 1582.

B. SPECIFICATION

[6][7][8][9] While terms are generally given their ordinary meaning, "[c]laims must be read in view of the specification, of which they are a part." *Markman*, 52 F.3d at 979; *see also Phonometrics, Inc. v. Northern Telecom Inc.*, 133 F.3d 1459, 1466 (Fed.Cir.1998)("Although claims are not necessarily restricted in scope to what is shown in a preferred embodiment, neither are the specifics of the preferred embodiment irrelevant to the correct meaning of claim limitations."). The relationship between the claims and the specification is illustrated by the following pair of claim construction canons: "(a) one may not read a limitation into a claim from the written description, but (b) one may look to the written description to define a term already in a claim limitation, for a claim must be read in view of the specification of which it is a part." *Renishaw PLC v. Marposs Societa' per Azioni*, 158 F.3d 1243, 1248 (Fed.Cir.1998). While additional limitations may not be imported into a claim from the specification, a court may construe a limitation specifically recited in a claim in light of the specification. *See Phonometrics, Inc. v. Northern Telecom Inc.*, 133 F.3d 1459, 1466 (Fed.Cir.1998). Thus, in order to inject a definition into a claim from the written description, the claim must explicitly contain a term in need of definition. *See Renishaw*, 158 F.3d at 1248, 1252 (noting that passages referring to the preferred embodiment cannot be read into the claim without some "hook"). Further, claim terms should not be narrowed by the content of the specification "unless the language of the claims invites reference to those sources." *Johnson Worldwide*, 175 F.3d 985, 990 (noting that there "must be a textual reference in the actual language of the claim with which to associate a proffered claim construction").

[10] The *Johnson Worldwide* court noted two specific situations in which a claim term may be given a definition other than its ordinary meaning: (1) if a patentee chooses to be his or her own lexicographer by explicitly setting forth the definition for a claim term, or (2) if "the terms chosen by the

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works

patentee so deprive the claim of clarity that there is no means by which the scope of the claim may be ascertained from the language used." 175 F.3d at 990. In these situations, reference should be made to the specifications to determine the meaning of the claims.

Because a patentee is free to be his own lexicographer, the specifications may serve as dictionary for certain terms in the claims. *Markman*, 52 F.3d at 979-80. However, in order for a patentee to assign a special definition to a claim term, he or she must do so clearly in the specification. *Markman*, 52 F.3d at 980; *see also Renishaw*, 158 F.3d at 1249 (noting that a "patentee's lexicography must, of course, appear 'with reasonable clarity, deliberateness, and precision' before it can affect the claim") (quoting *In re Paulsen*, 30 F.3d 1475, 1480 (Fed.Cir.1994)). "Without an express intent to impart a novel meaning to claim terms, an inventor's claim terms ***591** take on their ordinary meaning." *York Products, Inc. v. Central Tractor Farm & Family Center*, 99 F.3d 1568, 1572 (Fed.Cir.1996); *see also Vitronics*, 90 F.3d at 1582 ("Although words in a claim are generally given their ordinary and customary meaning, a patentee may choose to be his own lexicographer and use terms in a manner other than their ordinary meaning, as long as the special definition of the term is clearly stated in the patent specification or file history."). Thus, if a term is used in a variety of ways by the patentee in the specification, this may be indicative of the breadth of the term, rather than a limited definition. *See Johnson Worldwide*, 175 F.3d 985, 990-91 (distinguishing *Laitram Corp. v. Morehouse Industries, Inc.*, 143 F.3d 1456, 1463 (Fed.Cir.1998) on the ground that in that case a narrow interpretation was compelled because of unambiguous language in the specification made clear that the claim language had only one interpretation).

As for the second situation discussed in *Johnson Worldwide*, while a court generally construes claim terms consistent with their common meaning, a "common meaning, such as one expressed in a relevant dictionary, that flies in the face of the patent disclosure is undeserving of fealty." *Renishaw*, 158 F.3d at 1250. Also, a court may also resort to the specifications if a claim term lends itself to several common meanings; in such a situation "the patent disclosure serves to point away from the improper meanings and toward the proper meaning." *Renishaw*, 158 F.3d at 1250.

C. PROSECUTION HISTORY

[11][12] The third source of intrinsic evidence that a court may consider in understanding the meaning of the claims is the prosecution history. However, "[a]lthough the prosecution history can and should be used to understand the language used in the claims, it too cannot 'enlarge, diminish, or vary' the limitations in the claims." *Markman*, 52 F.3d at 980 (quoting *Goodyear Dental Vulcanite Co. v. Davis*, 102 U.S. 222, 227, 12 Otto 222, 26 L.Ed. 149 (1880)). A court also may consider the prior art cited in the prosecution history, which may contain clues as to what the claims do not cover. *See Vitronics*, 90 F.3d at 1583.

[13][14] If a patentee takes a position before the PTO, such that a "competitor would reasonably believe that the applicant had surrendered the relevant subject matter," the patentee may be barred from asserting an inconsistent position on claim construction. *Cybor Corp. v. FAS Technologies, Inc.*, 138 F.3d 1448, 1457 (Fed.Cir.1998); *see also Cole v. Kimberly-Clark Corporation*, 102 F.3d 524, 531 (Fed.Cir.1996) (holding that the patentee was estopped from arguing that her "perforation means" encompassed "ultrasonic bonded seams" after she distinguished references that contained such seams). If a patentee distinguishes a reference on multiple grounds to the PTO, any one of these may indicate the correct construction of a term. *See Gentry Gallery, Inc. v. Berkline Corporation*, 134 F.3d 1473, 1477 n. * (Fed.Cir.1998). However, "[u]nless altering claim language to escape an examiner rejection, a patent applicant only limits claims during prosecution by clearly disavowing claim coverage," that is, by making a statement that concedes or disclaims coverage of the claims at issue based on a piece of prior art. *York Products*, 99 F.3d at 1575.

D. EXTRINSIC EVIDENCE

[15][16][17] A court may, in its discretion, consider extrinsic evidence in order to correctly understand and define the language of the claims. *See Markman*, 52 F.3d at 980. However, "[e]xtrinsic evidence is to be used for the court's understanding of the patent, not for the purpose of varying or contradicting the terms of the claims." *Markman*, 52 F.3d at 981; *see also Vitronics*, 90 F.3d at 1584. Extrinsic evidence may be consulted if the court is not familiar with the terminology of art in which the patent is written, but it should not be ***592** consulted to clarify ambiguity in claim terms. *See Markman*, 52 F.3d at 986. "Indeed where the patent documents are unambiguous, expert testimony regarding the meaning of a claim is entitled to no weight." *Vitronics*, 90 F.3d at 1584.

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works

E. MEANS PLUS FUNCTION LIMITATIONS

Paragraph 6 of section 112 of 35 U.S.C. provides that:

> An element in a claim for a combination may be expressed as a means or step for performing a specified function without the recital of structure, material, or acts in support thereof, and such claim shall be construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereof.

This provision of the patent statute permits a patentee to write a limitation in a combination claim as a means for performing a function without reciting structure, material, or acts in the limitation. *See* *Valmont Industries, Inc. v. Reinke Mfg. Co., Inc.*, 983 F.2d 1039, 1042 (Fed.Cir.1993). A patentee who invokes this drafting tool is required, however, to describe in the patent specification some structure which performs the specified function. *See* *Valmont*, 983 F.2d at 1042.

[18] If a patentee uses the word "means" in a claim, a presumption arises that he or she used the word to invoke § 112, ¶ 6. *See* *Rodime PLC v. Seagate Technology, Inc.*, 174 F.3d 1294, 1302 (Fed.Cir.1999). There are two ways this presumption may be rebutted: (1) if a claim term uses the word "means" but recites no function which corresponds, or (2) if the claim recites a function but also recites sufficient structure or material for performing the claimed function. *See* *Rodime*, 174 F.3d 1294, 1302. It is also possible that a claim limitation that does not recite the word "means" may be construed under § 112, ¶ 6, despite a presumption to the contrary. *See* *Cole v. Kimberly-Clark Corporation*, 102 F.3d 524, 531 (Fed.Cir.1996) (citing *Raytheon Co. v. Roper Corporation*, 724 F.2d 951, 957 (Fed.Cir.1983)).

[19] Even if a mechanism is defined in functional terms, such as a "filter," "brake", "clamp," or "detent mechanism," or if it does not call to mind a single well-defined structure, it may not be subject to means-plus- function analysis. *See* *Greenberg v. Ethicon Endo-Surgery, Inc.*, 91 F.3d 1580, 1583 (Fed.Cir.1996) (noting that "[d]ictionary definitions make clear that the noun 'detent' denotes a type of device with a generally understood meaning in the mechanical arts, even though the definitions are expressed in functional terms" and that "[i]t is true that the term 'detent' does not call to mind a single well-defined structure, but the same could be said of other commonplace structural terms such as "clamp" or "container" "). In addition, a structural term need not connote a precise physical structure to those of ordinary skill in the art to avoid a means-plus-function analysis, as long as it conveys a variety of structures that are referred to by that term. *See* *Personalized Media Communications, LLC v. International Trade Commission*, 161 F.3d 696, 704-705 (Fed.Cir.1998) (noting that "detector" was not a generic structural term such as "means," "element," or "device" nor a coined term such as "widget" or "ram-a-fram" in deciding that use of the term "digital detector" did not subject the limitation to § 112, ¶ 6 analysis). The critical inquiry is "not simply that a [mechanism] is defined in terms of what it does, but that the term, as the name for structure, has a reasonably well understood meaning in the art." *Greenberg v. Ethicon Endo-Surgery, Inc.*, 91 F.3d 1580, 1583 (Fed.Cir.1996).

Once the court has determined that a claim limitation is written in means plus function form, the court must define what the "means" are in the claim. The first step is to determine the function that the ***593** claimed means performs. *See* *Rodime*, 174 F.3d 1294, 1302. The claim language must link the term "means" to a function or the limitation is not subject to 112, ¶ 6. *See* *York Products, Inc. v. Central Tractor Farm & Family Center*, 99 F.3d 1568, 1574 (Fed.Cir.1996). Next, the court must determine what structure, material, or acts disclosed in the specification correspond to the word "means." *See* *Chiuminatta Concrete Concepts, Inc. v. Cardinal Industries, Inc.*, 145 F.3d 1303, 1308 (Fed.Cir.1998).

[20][21] In determining the structure disclosed in the specification that corresponds to the means, the court should be wary of importing excess limitations from the specification. For example, if a structure is defined in the specification in a way unrelated to the recited function in the means-plus- function clause, those additional aspects of the structure should not be read as limiting the scope of the means clause. *See* *Chiuminatta*, 145 F.3d at 1308-1309 (construing a patent for an apparatus and method for cutting concrete, the court held that because the function that corresponded to the means in the limitation was supporting the surface of the concrete, structural aspects of the skid plate in the preferred embodiment that did not perform this particular function were not to be read as limiting the scope of the means clause). In addition, in construing means plus function claims, generally a court should not import a function of a working device or a preferred embodiment into the claims as part of the "means" if such a function is not part of the function recited in the claims. *See* *Rodime*, 174 F.3d 1294, 1305; *see also* *Constant v.*

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works

Advanced Micro-Devices, Inc., 848 F.2d 1560, 1571 (Fed.Cir.1988) ("Although the specification may aid the court in interpreting the meaning of disputed language in the claims, particular embodiments and examples appearing in the specification will not generally be read into the claims.").

II. CONSTRUCTION OF THE TWENTY CLAIMS PRESENTED AT THE *MARKMAN* HEARING

The twenty patent claims presented to the Court for construction at the *Markman* hearing may be categorized into the following groups: (1) Analysis Control System Claims, including Claim 51 of the '309 patent, Claims 33, 104, 117 and 192 of the '707 patent, and Claims 49, 50, 65, and 171 of the '863 patent, (2) Claims Involving Products Carrying Participation Numbers, including Claims 44 and 93 of the '707 patent and Claims 79 and 190 of the '863 patent, (3) Conditional Format Claims, including Claim 15 of the '150 patent and Claims 17, 20, 24, 77 of the '285 patent, and (4) Claims from the '984 patent, including Claims 4 and 15.

A. ANALYSIS CONTROL SYSTEM CLAIMS

The first set of claims, the Analysis Control System Claims, come from the '707, '863, and '309 patents. The text and figures of the specifications to these three patents are identical, so references to the specification in one patent are equally applicable to analysis of a term appearing in a claim in another of the three patents. The text of the analysis control system claims at issue is provided in the Appendix to this Memorandum.

In general, the '707, '863, and '309 patents describe a system which interfaces callers at remote terminals through a telephone network to provide voice prompts to the callers so that they can provide information to the system. The information from the callers may be stored in the system for processing. The content of the prompts provided by the system to the callers and the type of processing performed on the information provided by the callers is determined by a format, designed to implement, for example, an auction sale or a contest.

1. "Communication Facility"

[22] The parties have asked the Court to construe the term "communication facility." ***594** [FN1] The plaintiffs argue that although the term does not have a common meaning to one of ordinary skill in the art, [FN2] the meaning is clear from the claim language. The plaintiffs contend that because the purpose of the communication facility in the claims is to connect callers to the interactive voice application ("the Katz system"), the kind of communication facility is inconsequential and the Court should construe the term to mean "any telephone network that enables callers to make calls." (Pls.' Brief at 44-45).

FN1. The parties agree that the term "telephonic [or 'telephone'] communication system" is synonymous with "communication facility" and thus should be construed the same. The Court finds no reason in the claim language, specifications, or prosecution history of the patents which contain these terms to construe the two terms differently.
In addition to Claim 51 of the '309, the term "communication facility" or "telephonic [or 'telephone'] communication system" appears in the following claims: Claims 33, 44, 93, 104, 117 and 192 of the '707 patent, Claims 49, 50, 65, 79, 171, and 190 of the '863 patent, Claim 10 of the '309 patent, Claims 17, 20, 24, and 77 of the '285 patent, and Claim 15 of the '984 patent. There being no indication to the contrary, the Court concludes that these terms have one meaning across all the patent claims at issue in the *Markman* hearing.

FN2. Both Mr. Morganstein, the expert for the plaintiffs, and Professor Larky, one of the experts for the defendants, testified that a person of ordinary skill in the art of interactive voice response systems would have had at least a Bachelor's degree in a scientific or engineering field, such as physics, electrical engineering, or computer science, and at least two years experience working in the field of computer telephony. (Transcript volume 1 at 77-78; volume 3 at 39).

The defendants attack this proposed construction of communication facility and argue that the Court should construe the term as requiring that (1) the communication facility comprise the entire Public Switched Telephone Network ("PSTN") [FN3] and (2) the Katz system must be operated only outside the PSTN or communication facility. To support their argument that the communication facility comprises the entire PSTN, the defendants point to particular

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works

language in the specifications that they contend supports such a construction. First, the defendants point to Column 3 of the '707 patent at line 13, which provides that "[i]n the disclosed embodiment, the remote terminals T1 through Tn represent the multitude of conventional telephone terminals that are coupled to a communication facility C which may take the form of a comprehensive public telephone system for interconnecting any associated terminals T1-Tn." Because the specification indicates that the communication facility has the ability to connect *any* associated terminals (such as telephones), the defendants argue that the communication facility must include the entire PSTN. Similarly, the defendants argue that Katz defined communication facility as the entire PSTN in line 63 of Column 4 of the '707 patent, which provides that "DNIS capability is a function of the communication facility C (composite telephone system)." The defendants maintain that these passages of the specification indicate that the communication facility should be construed to mean the entire PSTN.

> FN3. Professor Larky defined the PSTN as the comprehensive public telephone system which "includes the operations of the various local exchange carriers (such as Bell Atlantic), and interexchange (long distance) carriers, such as AT & T and MCI." (Expert Report of Larky at 14). Although, the Court did not need to draw on expert testimony to construe the meaning of the term "communication facility," reference to the expert's report to understand the meaning of the term PSTN is essential to understanding the defendants' argument.

The plaintiffs argue that the passages relied on by the defendants do not support their construction and that the specification indicates a contrary definition of "communication facility." In Column 17 of the '707 patent, Katz states that callers to his system could be billed through the "pay-to-dial network." The plaintiffs argue that this indicates that "communication facility" may comprise any part of the ***595** PSTN, including the pay-to-dial network, that allows calls to be made by a caller to the Katz system and does not require that it comprise the entire PSTN. In addition, the plaintiffs contend that the prosecution history supports this construction. In a Preliminary Amendment dated January 10, 1986 in the prosecution of the '299 patent, Katz amended his claims to replace the term "public communication facility" with the term "communication facility." (Ex. 26). Katz also added a claim during the prosecution of the '299 patent, claim 15, which provided: "A system according to claim 1 wherein said communication system comprises a public communication system." (Ex. 26). By altering his claims, the plaintiffs argue, Katz clearly did not limit his claims to *always* require use of the entire PSTN.

This Court concludes that the claim language does not shed much light on the scope of the communication facility; however, there is no indication from claim language itself that the communication facility must include the entire PSTN. The specification is more helpful in determining the scope of the term at issue. In Column 3, lines 55-59 of the '707 patent, Katz states that "[i]n the illustrative embodiment of the system, the communication facility C comprises a public telephone network." This indicates that the communication facility may, but is not required to involve the entire PSTN. In addition, the prosecution history of '299 patent cited by the plaintiffs, in which Katz removed the word "public" from modifying "communication facility," is consistent with this indication. The references to the specification made by the defendants do not undermine this reading of the claim language and specification and do not lend support to the defendants' proposed construction of this term. Thus, I conclude that in light of the claim language, specifications, and prosecution history presented by the plaintiffs, the term "communication facility" does not require the involvement of the entire PSTN or thus, all of its elements and processes.

To support their argument that "communication facility" is defined in the patents such that the Katz system must be operated only *outside* the PSTN or communication facility, the defendants point to the language of the preamble and claim limitations. The parties agree that because the terms "communication facility" and "analysis control system," which initially appear in the preamble, are referred to in the claim limitations, these terms should be considered as limitations in the claims. *See* *Gerber Garment Technology, Inc. v. Lectra Systems, Inc.*, 916 F.2d 683, 689 (Fed.Cir.1990). The preamble provides for "[a]n analysis control system for use with a communication facility;" the defendants contend that this language, particularly the word "with," indicates that the Katz system, the analysis control system, is necessarily outside of the network. Further, the defendants argue that because the preamble indicates that the communication facility provides call data signals to the Katz system, this indicates that Katz was not referring to the internal routing signals that

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works

occur inside the telephone network.

Turning to the language of the claim limitations, the defendants point out that Katz used the phrase "coupled to said communication facility," which they argue indicates that the Katz system is something distinct from the communication facility because it is "coupled to" it. The defendants also contend that the limitation "interface structure coupled to said communication facility ... including means to provide signals representative of data developed by said remote terminals and for receiving said calling number identification data and said called number identification data (DNIS) to identify one from a plurality of called numbers" indicates that the interface structure cannot be a switch inside the PSTN, because switches *send* ***596** DNIS, not receive it. [FN4] This, the defendants argue, is further proof that the Katz system cannot include any elements or processes which are inside the PSTN.

> FN4. This limitation is not present in Claim 51 of the '309 patent, but it and similar limitations appear in other claims in which the term "communication facility" is used. *See, e.g.,* Claim 171 of the ' 863 patent (dependent on Claim 93 of the '863).

In addition, the defendants refer the Court to Figure 1 in the specification. First, the defendants argue that the Katz system is represented as a "dead-end" or the place at which a call terminates, not as a mechanism by which calls are connected from one person to another, as is the function of the PSTN. Second, the defendants argue that pursuant to the Code of Federal Regulations, if an aspect of the invention is represented in the figure as a rectangular box, it indicates that that aspect is not essential to the understanding of the invention, citing 37 C.F.R. § 1.83(a). Thus, the defendants argue, the fact that the communication facility is represented in the figure as an empty box lends support to their position that the Katz system must be operated only outside the network.

Finally, the defendants point to the specification of the '707 patent at Column 6 at line 14, which provides that "individual callers would use the remote terminals T1-Tn to contact the central station D through the communication facility," as indicating that by using the word "through," Katz indicated that the Katz system must be operated only outside the PSTN.

The plaintiffs argue that the claim language is silent as to whether the Katz system must function only "inside" or "outside" the network. Further, the plaintiffs argue that there is nothing in the specification that requires that the Katz system function only outside the network. The plaintiffs maintain that although the communication facility is represented in Figure 1 as an empty box, certain parts that the defendants would consider to be "inside" the PSTN, such as the remote terminals and customer billing, are split out and shown as separate boxes in Figure 1. Thus, the plaintiffs contend that if customer billing and the remote terminals can be shown as separate empty boxes and still be "inside" the PSTN, there is no basis in Figure 1 for construing the Katz system, which is also represented by separate boxes, as "outside" the PSTN.

The Court concludes that there is no basis in the claim language, the specifications, or in Figure 1 to construe the term "communication facility" to mean that the Katz system must be operated only outside the communication facility. It appears that the essence of the defendants' argument here is that the Katz system cannot run on any of the equipment that is part of the communication facility, and thus, is "outside" of the communication facility. The Court is not persuaded that the words "for use with," "through" or "coupled to" indicates that the Katz system must be operated only outside the communication facility. The words "with," "through," and "coupled to" connote some type of relationship between two things; however, none of these terms means that the two things in the relationship cannot be considered part of the same system or entity.

Finally, the defendants argue that, claim language and specification aside, Katz clearly limited his invention to a system only existing outside the communication facility in his representations to the PTO during the prosecution of his patents. The defendants point to comments by Katz during the prosecution of the '707 patent regarding patents to DeBruyn, Riskin, Comella, and Daudelin. Specifically, the defendants point out that in an Amendment dated August 31, 1995, Katz stated that he amended his claim to recite "that processing of at least certain of the data developed by the terminals and the calling number identification data occurs in the Applicant's system" and that "[n]either DeBruyn nor Riskin teach this aspect of the Applicant's system, also neither patent ***597** teaches calling number identification data provided automatically by a communication system (for example, ANI or like signals)." (Ex. 51).

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works

In addition, the defendants point out that in the same Amendment, Katz noted in part that Comella's system "replaces the function of an operator for certain types of calls, for example, collect calls, person-to-person calls, charge-to- third number calls and so on" and that the patent to Comella "is somewhat of background interest for its interface aspects." (Ex. 51). As for the patent to Daudelin, the defendants point out that Katz described it as "generally directed to an interface arrangement for reducing the load on telephone operators." (Ex. 51). Apparently, the defendants contend that if Katz had contemplated that his system could have operated inside the PSTN, he should have said a lot more than he did to adequately distinguish his invention from the Daudelin and Comella patents, which were inventions that were operated by the PSTN.

Whether Katz complied with his obligations before the PTO, however, is a question for another day; the question before the Court is whether Katz made any statements to the PTO that limited the scope of his claims. Considering the passages of prosecution history flagged by the defendants, the answer to that question is no: The Court concludes that the statements by Katz regarding these patents do not constitute a representation from him to the PTO that his invention could be operated only "outside" the communication facility.

Further, the defendants point to statements made by Katz to the PTO in the September 19, 1994 Supplemental Information Disclosure Statement ("IDS") during the prosecution of the '575 patent, which occurred while the application of the '707 patent was still being prosecuted. Specifically, the defendants point to a passage in which Katz referred to a patent by DeBruyn and stated in part that the patent to DeBruyn "discloses a lottery system that is integral with the 'Telephone Company,' " and that in Katz' system, "the 'Telephone Company' ('a communication facility') simply provides an interface, the lottery system being a separate and distinct capability." (Ex. 41). However, taking the statements highlighted by the defendants in context, Katz points out differences between his system and the DeBruyn system including that in Katz system the caller must enter "lottery and identification data," while in the DeBruyn system, the caller need not enter such information because the system is run inside the "Telephone Company" where the callers' telephone number is already known. These statements highlight that the Katz system requires that a caller enter certain data, which is not required by the DeBruyn system; the statements do not limit the physical or geographic location where the Katz system can or cannot operate.

Similarly, the defendants refer to another piece of prosecution history in which Katz discussed a patent to DeBruyn for a telephonic lottery system. (Ex. 46). In the September 30, 1994 IDS in the prosecution of the '120 patent, [FN5] Katz stated that DeBruyn was distinct from his system which received identification from a caller because the it was "integrated with the composite telephone system which could identify the subscriber's telephone number." The Court concludes that the statements of Katz in the September 19, 1994 Supplemental IDS and the September 30, 1994 IDS do not restrict or limit the term "communication facility" to mean that the Katz system must be operated only outside of it.

> FN5. The '120 patent is related to the patents-in-suit; the defendants cite to this prosecution history because the claims at issue contain language regarding the communication facility which is similar to the patents before the Court. (Defs.' Brief at 34 n. 20).

The defendants argue that Katz also distinguishes his system from the routing and connection of telephone calls, which ***598** are integral functions of a telephone company, thereby establishing that his system was to operate only outside the network. The defendants point to a statement made by Katz regarding a patent to Riskin in the prosecution of the '075 patent. (Ex. 40). In the Preliminary Amendment dated July 17, 1990, Katz stated that "[r]ecognizing that the Riskin patent discloses the utilization of ANI and DNIS signals to accomplish telephone routing, it is respectfully submitted that applicant's system involves entirely different philosophical considerations and structure." The defendants contend that because the Riskin patent was a system that was inside the telephone network, this statement by Katz indicates that his system was to be operated outside the PSTN. Similarly, the defendants argue that Katz distinguished his invention during the prosecution of the '929 patent [FN6] from a patent to Riskin by stating that his invention was outside the PSTN. (Ex. 37). In the Amendment dated August 1, 1990, Katz noted that in the Riskin patent, "functions are involved that are completely distinct from applicant's system.... Specifically, Riskin does not disclose an interface telephone system but rather discloses a connection system." The Court concludes that in these statements, however, Katz is

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works

discussing functional differences between the Riskin system and his system, not differences in the physical or geographic location of the elements of the systems.

FN6. The '929 patent is a direct descendant of the '299 Application, from which all the patents-in-suit descend.

Essentially, the defendants are attempting in their arguments regarding "communication facility" to put a non-infringement rabbit in their hat at the claim construction stage of the case; in their arguments, they expressly seek to include any and all of their equipment, wires, switches, computers, trunks, lines, databases, and so on in the definition of "communication facility" and then establish that the Katz system cannot by definition include any of those things or run on any of that equipment because his system must be "outside" the communication facility. The result of adopting such reasoning would be to restrict the definition of "communication facility" on the basis of who owned the computer or switch on which the Katz system was running or on the basis of the physical or geographic location of the particular computer or switch. The plain words of the patents will not support such a restricted definition.

Based on the foregoing inspection of the claim language, specification, and prosecution history, the Court construes the term "communication facility" in the Katz patents to mean: that part of a telephone network that enables a caller to connect to the Katz system. The Court concludes that there is no support for a construction of "communication facility" to require that the Katz system be operated only outside the entire PSTN nor that the "communication facility" encompass the elements or processes of the entire PSTN.

2. Application of Means-Plus-Function Analysis

The analysis control system claims contain several limitations that contain a "structure" or "means" term, such as "interface structure," "voice generator structure," and "means to provide call data signals representative of data developed by said remote terminals." While the parties agree that some of these terms are subject to means-plus-function analysis under 35 U.S.C. § 112, ¶ 6, the plaintiffs dispute the application of such analysis to other terms.

a. "Interface Structure"

[23] The first of these terms the parties wish the Court to construe is "interface structure." [FN7] The claim limitations in ***599** which this term appears read "an interface structure coupled to said communication facility to interface said remote terminals for voice and digital communication." In some of the claims, the limitation goes on to provide that the interface structure includes "means to provide caller data signals representative of data relating to said individual callers developed by said remote terminals." [FN8] Other claims contain limitations which further provide that the interface structure includes means "for receiving said calling number identification data." [FN9]

FN7. The term "interface structure" appears in the following claims under consideration at the *Markman* hearing: Claim 51 of the '309 patent, Claims 33, 104, 117 and 192 of the '707 patent, and Claims 49, 50, 65, and 171 of the '863 patent.

FN8. Claims which include this or similar language are Claims 51 of the '309 patent, Claims 104 and 117 of the '707 patent, and Claims 49, 65, and 171 of the '863 patent.

FN9. Claims which include this or similar language are Claims 104, 117, and 192 of the '707 patent and Claims 49, 65, and 171 of the ' 863 patent.

The dispute between the plaintiffs and the defendants centers around whether "interface structure" is subject to means-plus-function analysis under 35 U.S.C. § 112, ¶ 6. The plaintiffs maintain that the term does not implicate § 112, ¶ 6 and should be construed to mean "a hardware device with associated software that establishes an interactive connection between a caller's telephone and a computer system." (Pls.' Brief at 50). The plaintiffs argue that under *Personalized Media Communications, LLC v. International Trade Commission*, 161 F.3d 696, 704-705 (Fed.Cir.1998), a term that is defined in terms of its function or that does not bring to mind one well-defined structure is not necessarily subject to means-plus-function analysis. In *Personalized Media*, the Court of Appeals for the Federal Circuit held that the term "digital detector" was not subject to means-plus-function analysis because it conveyed to one of ordinary skill in the art "a variety of structures known

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works

as detectors." *Id.* at 705. The plaintiffs argue that the term "interface structure" is akin to "digital detector" in that it is a sufficient recitation of structure so as to avoid the application of means-plus-function analysis. The plaintiffs argue that a specific set of structures corresponding to "interface structure" was known to those of ordinary skill in the art at the time of the prosecution of the Katz patents.

The defendants argue that the term "interface structure" is written in functional language, fails to sufficiently connote structure to those of ordinary skill in the art, and as such, it subject to analysis under § 112, ¶ 6. The defendants contend that Katz simply used the term "structure" instead of "means" to attempt to avoid the application of § 112 ¶ 6. The defendants maintain that "interface structure" is a generic term which does not inform a person of ordinary skill in the art what structure is being conveyed by the term.

[24] Because the term "interface structure" is not drafted in "means for" form, the Court presumes that it is not subject to the requirements of § 112 ¶ 6. *See* Mas-Hamilton Group v. LaGard, Inc., 156 F.3d 1206, 1213 (Fed.Cir.1998). The critical factor in determining whether a term in a limitation which does not invoke "means for" language is subject to means-plus- function analysis despite the presumption to the contrary is whether the term brings to mind a set of structures to those of ordinary skill in the art, and not whether the term is written in functional language. *See* Personalized Media, 161 F.3d at 704-705. To determine whether this term would connote sufficient structure to those of ordinary skill in the art, this Court must refer to references in the computer telephone field contemporary with the prosecution of the Katz patents. *See* Greenberg, 91 F.3d at 1583 (consulting dictionaries to determine that the term "detent" denoted a device generally understood to those in the mechanical arts).

***600** In an article in the AT & T Technical Journal regarding the Conversant 1 Voice System, [FN10] "trunk interface units" are described as connecting incoming trunks from a central office in the telephone network, and "line interface units" are described as initiating or receiving calls over ordinary telephone lines. (Ex. 366). In an 1985 article entitled "The AT & T Multi- Mode Voice SystemsFull Spectrum Solutions for Speech Processing Applications," the authors refer to "telephone interface units (either line or trunk circuits)" as being a component of a basic system for speech processing applications using the telephone network and centralized databases. (Ex. 358). Other references in the record indicate that "interface structure" connoted structure to those of ordinary skill in the art: Exhibit 355, an article regarding Periphonics Voicepac, describes a particular brand of device used as an interface; Exhibit 405, a 1986 article on the Conversant 1 Voice System, discusses the function of line and trunk interfaces; Exhibit 250, the 4,866,756 patent to Crane et al., incorporates a "telephone interface component" to transmit audio response signals; and Exhibit 235, the 4,797,911 patent to Szlam et al., incorporates "trunk interface units" into its customer account online servicing system.

FN10. The date of this article is unclear in the record, but there is some indication in the article that the manuscript was revised in 1986.

One technical dictionary cited by the plaintiffs was helpful in assisting the Court determine what "interface structure" meant to those in the art. In the *Dictionary of Computing and New Information Technology* by A.J. Meadows, et al. (1982), the term "interface" is defined as being "[u]sed as a general term to describe the connecting link between the two systems. Most frequently refers to the hardware and software required to couple together two processing elements in a computer system." (Ex. 481).

While the testimony of the experts at the *Markman* hearing is not as weighty as prior art and technical references in determining the state of the art at the time of the prosecution of the Katz patents, it is consistent with the above references in indicating that "interface structure" had meaning and brought to mind a set of structures to those in the field. *See* Morganstein Testimony, Transcript Volume 1 at 173, line 24 to 176, line 2 (testifying that the term "interface structure" would have had meaning to a person of ordinary skill in the art who had read the Katz patents and would have brought to mind a range of structures such a person could have used to build the Katz inventions); Larky Testimony, Transcript Volume 3 at 64 lines 12-15 (testifying that he recognized that the term "interface structure" referred to "some physical structure" but not a specific structure).

Based on the above references and expert testimony, the Court concludes that although the term "interface structure" is written in functional language, the limitation sufficiently connotes structure such that §

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works

112, ¶ 6 does not apply. That is, I conclude that, based on the cited prior art, references, and testimony of the experts at the *Markman* hearing, the term "interface structure" would have called to mind a specific set of structures to a person of ordinary skill in the art such that such a person would be able to build the Katz inventions.

Having concluded that the term "interface structure" is not subject to § 112, ¶ 6, the Court must construe the meaning of the term according to the regular rules for claim construction. The meaning of "interface structure" to those of ordinary skill in the art at the time has been discussed above. In addition, in Column 4, line 52 to Column 5 line 15 of the '707 patent, Katz discusses the function and components of the interface structure and states that "the interface 20 incorporates modems, tone decoders, switching mechanisms, DNIS and ANI capability (call data analyzer 20a) ***601** along with voice interface capability" and that the "interface 20 provides the connection of the first lines to a switch 21 which are in turn coupled to first function units, or processors PR1 to PRn." This description of the interface in the specification is consistent with the ordinary meaning of the term "interface structure" to those of skill in the art. Based on the foregoing, I construe the term "interface structure" in the Katz patents to mean "the hardware and software required to connect the processors upon which the Katz system is running to the communication facility such that information from the communication facility and the remote terminals may be provided to and received by the Katz system." For the claims listed in footnote 8, *supra,* the Court construes the term "interface structure" to also include the means to perform the specific function of providing caller data signals representative of data developed at the remote terminals. For the claims listed in footnote 9, *supra,* the Court construes the term "interface structure" to also include the means to perform the specific function of receiving calling number identification data.

b. "Means to Provide Caller Data Signals" and "Means to Receive Calling Number Identification Data"

[25] Some of the limitations beginning with the term "interface structure" contain terms drafted in "means for" language, including "means to provide caller data signals" in Claims 51 of the '309 patent, Claims 104 and 117 of the '707 patent, and Claims 49, 65, and 171 of the '863 patent, and means "to receive calling number identification data" in Claims 104, 117, and 192 of the '707 patent and Claims 49, 65, and 171 of the '863 patent. [FN11] Both sides agree that these terms are subject to means-plus- function analysis. The plaintiffs argue that the structure that corresponds to the "means" in "means to provide caller data signals" is the Interface 20 in Figure 1 or Interface 1A sub1 through 1A subN and 1B sub1 through 1B subN in Figure 9 of the '309, '707, and '863 patents. The plaintiffs argue that the structures in Figure 1 that correspond to the "means" in "means to receive calling number identification data" are the Interface (20) and the Call Data Analyzer (20a). The defendants argue that the "means" in both of these means- plus-function limitations corresponds to the structures referenced by the plaintiffs but also corresponds to the Automatic Call Distributor ("ACD").

> FN11. Some of the claims contain slight variations on this language, but the Court concludes the meaning of the various phasing of this concept is the same.

The Court concludes that the phrases "means to provide caller data signals" and "means for receiving said caller number identification data" are written in "means for" form, do not recite sufficient structure in the claim language, and are subject to analysis under § 112, ¶ 6. According to the specification of the '707 patent at Column 4, lines 28-31, the ACD functions to "queue incoming calls for connection to a lesser number of lines." The ACD does not fulfill and is not necessary to the function of providing call data signals or receiving calling number identification data and thus does not correspond to the "means" in those limitations. The Court concludes that the structure disclosed in the patents that corresponds to the "means" in the "means to provide caller data signals" is the Interface 20. The Court concludes that the structures disclosed in the patents that correspond to the "means" in "means for receiving calling number identification data" are the Interface 20 and the Call Data Analyzer 20a.

c. "Voice Generator Structure"

[26] The term "voice generator" appears in several of the analysis control system claims at issue, and the limitations containing this term read "voice generator structure coupled through said interface structure for actuating said remote terminals as to provide vocal operating instructions ***602** to said individual callers." [FN12] The parties agree that the term "voice generator structure" is not subject to means-plus-function analysis because the term connotes a

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works

specific range of structures that correspond to the term to those of ordinary skill in the art. The Court concludes that the plain meaning of the term "voice generator" indicates a structure that can produce vocal sounds. The specification of the patents in which this term is found describes the voice generator structure as "a voice origination apparatus may prompt individual callers who (after qualification) provide select digital data to develop a record for further processing." Column 2 lines 4 to 8 of the '707 patent. The specification also provides that the voice generator is incorporated in the interface, Column 4, lines 55 to 58 of the '707 patent, and that "recorded voice messages prompt callers to provide data by actuating the alphanumeric buttons"on their telephones, Column 1, lines 45 to 47 of the '707 patent. Based on the term's ordinary meaning, the claim language, and the specification, the Court concludes that "voice generator" means: a device for generating vocal instructions or prompts to individual callers at the remote terminals.

FN12. The term "voice generator structure" is found in Claim 51 of '309, Claims 33, 104, 117, and 192 of the '707 patent, and Claims 65 and 171 of the '863 patent. In Claim 192 of the '707 patent, the limitation provides that the voice generator structure is also able "to prompt said individual callers to enter data."

d. "Record Structure"

[27] The term "record structure" begins limitations in many of the Analysis Control System Claims at issue; the limitation in Claim 51 of the '309 patent reads "record structure, including memory and control means, connected to receive said caller data signals from said interface structure for updating a file and storing digital caller data relating to said individual callers provided from said digital input means through said interface structure." [FN13]

FN13. The term "record structure" appears in the following claims: Claim 51 of the '309 patent, Claims 33, 104, 117, and 192 of the '707 patent, and Claims 49, 50, 65, and 171 of the '863 patent. The wording of the record structure limitations varies across these claims; however, all include "memory and control means" and the concept of receiving information about callers from the interface structure or the communication facility and then storing, updating, accessing, or testing that information. Thus, the definition of the term "record structure" will be the same across the claims at issue in which it appears.

The plaintiffs argue that "record structure" is not subject to means-plus- function analysis because the term connotes structure to those of ordinary skill in the art. Morganstein testified at the *Markman* hearing that a person of ordinary skill in the art who had read the Katz patents would have understood "record structure" to refer to a set of structures; Morganstein testified that the record structure would correspond to one of the building blocks of interactive voice applications, including processors, memory, and software. (Transcript volume 1 at 181-182). Larky did not disagree with Morganstein and testified that "record structure" would have connoted structure to those in the field. (Transcript volume 3 at 67-68). The plaintiffs also argue that the phrases "including memory" [FN14] and "connected to receive said caller data signals from said interface structure" are additional structural descriptions of record structure in the claims which support their position that the term does not implicate § 112, ¶ 6. The plaintiffs' proposed construction of this term is "a hardware device with associated ***603** software, including memory and control means, used to store information." (Pls.' Appendix at 132).

FN14. It appears that both sides agree that the term "memory" does not implicate § 112, ¶ 6. Morganstein testified at the *Markman* hearing that a person of ordinary skill in the art would have been aware of many kinds of "memory," such as RAM, tapes, cassettes, and disks. *See* Morganstein Testimony, Transcript volume 1 at 106. Thus, the Court construes the term "memory" according to its plain meaning as: computer hardware that stores information, such as disks, RAM, or tapes.

The defendants argue that "record structure" is subject to § 112, ¶ 6 because the term is defined by the function it performs--accessing a file and storing data--and because it lacks a sufficiently definite structure to those of ordinary skill in the art. The structures that correspond to this term, the defendants argue, are the Processing Unit 92, Memory 98 with storage cells C1 through Cn in Figure 4, and the required wiring to connect these structures together.

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works

The defendants argue that "record structure" also corresponds to the required software for performing the disclosed functions. The defendants contend that the only software programs disclosed in the specifications are in the context of the specific "formats" described by Katz, such as game shows, lotteries, and auctions. [FN15]

> FN15. The defendants argued as well on other claim terms that the structures corresponding to the means in mean-plus-function limitations included software that was particularly programmed to carry out one of the seven formats disclosed in the specifications or to perform "statistical analysis to isolate a subset." In support of this argument, the defendants submitted the recent case of *WMS Gaming Inc. v. International Game Technology*, 184 F.3d 1339 (Fed.Cir.1999) after the close of the *Markman* hearing. Upon full consideration of the *WMS Gaming* case and the letters submitted to the Court by the parties regarding this issue, the Court concludes that the new decision by the Federal Circuit does not require that the software corresponding to the means in these limitations be specifically programmed to perform one of the seven formats disclosed in the specifications or statistical analysis to isolate a subset of callers or data.

Based on contemporary technical dictionaries and the testimony of the experts, the Court concludes that the term "record structure" is not subject to § 112, ¶ 6 because the term would have connoted sufficient structure to those of ordinary skill in the art. The Court construes the term "record structure" to mean: computer hardware and software required to receive data signals, update files, and store information.

The limitations containing the term "record structure" provide that the record structure includes memory and "control means ... for accessing a file." The parties agree that "control means" is subject to § 112 ¶ 6. The plaintiffs point to the Processing Unit 92 and Memory 98, including cells C1 through Cn in Figure 4 or Processors PR1 through PRn in Figure 1 as the structures that correspond to "control means." The plaintiffs contend that an alternative structure for control means disclosed in the patents is a microcomputer or microprocessor, such as the Central Processing Unit 251 in Figure 9, programmed to perform the disclosed functions.

The defendants agree that the term "control means" corresponds with the structures the plaintiffs have identified, but the defendants contend that the term also must include the associated wiring and software.

The first step in means-plus-function analysis is to identify the function performed by the means; here, the function of the "control means" is to receive calling number identification data, to access a file, and to store data relating to certain of said individuals callers. The Court concludes that the patent discloses that the control means correspond to the Processing Unit 92 and Memory 98, including the cells, C1 through Cn in Figure 4 and the Processors PR1 through PRn in Figure 1. *See* Column 16, lines 24-28, and 44-46 of the '707 patent and Column 18, lines 21-25 of the '707 patent. In addition, "control means" corresponds to the software that enables these structures to perform the functions of receiving and storing data and accessing files. The Court concludes that the control means also correspond to a microprocessor, such as the Central Processing Unit 251 in Figure 9, programmed to perform the disclosed functions, as such a structure can also perform the disclosed ***604** functions of the control means. *See* Column 5, lines 12-33, Column 9, lines 59 to 67, and Column 21, lines 9-20 of the '707 patent.

The core dispute between the parties in relation to the record structure limitations is over the meaning of the term "accessing." The plaintiffs argue that the term "accessing" includes anything a computer can do to a file, such as creating or opening records or storing additional information entered by callers. The defendants argue that the term "accessing" does not encompass deleting a file or creating or initiating a file because a file must exist before it can be "accessed." The defendants point to passages of the specification in which the ideas of updating a file are distinct from creating a cell in memory in the first instance. *See* Column 12, line 63-65, Column 16, lines 29-32, and Column 17, lines 29-30 of the '707 patent. Thus, they contend that the term "accessing" must mean retrieving a file that already exists.

In Claim 51 of the '309 patent, Katz recites a "record structure, including memory and control means, ... for *updating* a file." This indicates to the Court that the use of the word "accessing" in a similar limitation in another claim connotes a different meaning. Further, although Katz describes updating files and assigning cells in memory as different functions in the specification, there is nothing in the specification that indicates that the term "accessing" could not

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works

encompass both of those functions.

Webster's Dictionary defines the verb "access" as "to get at, gain access to." Addenda to *Webster's 3rd New International Dictionary* at 55a (1986). As a noun, the term is defined as "permission, liberty, or ability to enter, approach, communicate with, or pass to and from" or "freedom or ability to obtain or make use of." The Court concludes that the term "accessing" means in the context of the Katz patents: gaining or obtaining the ability to enter or make use of files. The Court further concludes that the term "accessing" in the context of the Katz patents does not delineate or restrict the types of functions that may be performed on the files once they are accessed, such as updating files, creating new files, or deleting files.

e. "Qualification Structure"

[28] "Qualification structure" appears in many of the Analysis Control System Claims, and the limitations in which this term appears vary from claim to claim. [FN16] Claims 104 and 117 of the '707 patent and Claim 171 of the '863 patent include the broadest limitation including the term, providing for a "qualification structure controlled by said record structure for controlling access to said system by said individual callers." The other limitations containing this term vary on how and on what basis access to the system is controlled.

FN16. The term "qualification structure" appears in Claim 51 of the '309 patent, Claims 33, 104, and 117 of the '707 patent, and Claims 49, 50, 65, and 171 of the '863 patent.

The plaintiffs argue that this term is not subject to means-plus-function analysis because the term "qualification structure" was well known to those of ordinary skill in the art of building interactive voice applications. The plaintiffs contend that "qualification structure" would have brought to mind a computer processor and its software programs to those of skill in the art.

The defendants argue that this term is subject to means-plus-function analysis because it is written in functional terms and has no meaning to those of ordinary skill in the art without more information than is provided in the claim language. The defendants argue that the term does not escape application of § 112, ¶ 6 because it calls to mind a computer processor and its programs, as plaintiffs contend. The defendants argue that the structure in Figure 4 that corresponds to this term is the Qualification Unit 93, the Processing Unit 92, the Memory 98, and the software required to qualify callers. *See* Column 6, ***605** line 56 to Column 7, lines 36 and Column 16, lines 19-31 of the '707 patent. The defendants contend that the only software that is disclosed in the patents is in the context of the specific formats discussed by Katz, such as game shows, lotteries, and auctions.

The Court concludes that although the term "qualification structure" does not include the term "means," it is subject to § 112, ¶ 6. "Qualification structure" is written in functional terms and the Court is not convinced that it would not have brought to mind sufficient structure to a person of ordinary skill in the art without further reference to the specification. The function performed by the "qualification structure" is controlling access to the Katz system by individual callers. The structures disclosed in the specification that perform this function are the Qualification Unit 93 and the Processor 92 in Figure 4. [FN17]

FN17. For the term "qualification structure" in Claim 33 of the '707 patent, which provides for "[a]n analysis control system according to claim 26, wherein said limit on use restricts relates to a dollar amount," the defendants claim that the corresponding structures are the Qualification Unit (93) and Look-up Table (99) or Use Rate Calculator (100) in Figure 4, as well as the software required to perform the function of testing the data from callers to specify a basis for entitlement to assess to the Katz system. *See* Column 17, lines 38-62 of the '707 patent. The Court concludes that these structures designated by the defendants correspond to the qualification structure in Claim 33 of the '707 patent.

The qualification structure limitations raise additional construction issues. In Claims 49 and 50 of the '863, the qualification structure controls access to the Katz system "based on at least two forms of distinct identification including caller customer number data and at least one other distinct identification data element consisting of personal identification data." The parties agree that a "caller customer number" is a number that is assigned to a merchant's own customer; however, the defendants

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works

contend that the caller customer number cannot be a credit card number because it is not assigned from a vendor to a customer. The defendants point to Column 11, lines 6-7 of the '863 patent, which describes the customer number in a mail order format as the number found on the customer's catalog. Thus, the defendants argue the customer number cannot be a credit card or charge number because such a number does not identify the caller as a customer of the merchant. In Column 11, lines 19-22 of the '863 patent, Katz states that a caller's customer number may be stored along with his credit card number and expiration date; the defendants argue that this indicates that a customer number and a credit card number are two separate items.

The defendants also argue that the second piece of identification data cannot be a personal identification number (PIN) or an expiration date from a credit card because such numbers are not unique to the individual, or "personal," without the corresponding credit card number or calling card number. The defendants point out that in Column 11, lines 1-5 and 19-22 of the '863 patent, Katz describes "other distinct identification data" in the mail order format as both a credit card number and its expiration date.

Along with the specification, the defendants point to the prosecution history of the '707 patent as support for their construction of "caller customer number data" and "other distinct identification data." In the May 8, 1995 Office Action during the prosecution of the '707 patent, the examiner rejected pending Claim 33, which provided for a "record structure with means for recording an identification card number and at least one other distinct identification data element," as unpatentable over the '554 patent to Asmuth. The examiner noted that Asmuth contained the "record structure" of Katz's claim and taught "that input 'caller data signals' may include a telephone credit card number (in the claim 'identification card number') ... and a 'distinct identification data element' consisting of 'personal identification data' (in the patent ***606** a 'PIN')." Katz subsequently amended what was then Claim 33 to recite a qualification structure in a form similar to the claims at issue. *See* August 31, 1995 Amendment. In his comments to that amendment, Katz stated that he added a "qualification structure" requiring two forms of distinct identification including a caller's customer number to qualify a caller, and that the addition of the qualification structure and the fact that Asmuth stored data to define the virtual private network while his invention stored data developed by the callers rendered the Katz invention distinct.

As for the term "caller customer number data," the claim language does not support the narrow construction proposed by the defendants. That is, there is no support in the claims for the notion that this form of identification could not be a credit card or other charge number if such a number identified the caller as a customer of a particular merchant or vendor. The mention in the specification of storing the customer number as distinct from the credit card number was given as an example; similarly, the example of the customer number located on a customer's catalog was not provided as a requirement for a customer number.

The second term, "distinct identification data element consisting of personal identification data," is not subject to the narrow construction proposed by defendants either. The word "distinct" indicates that this second form of identification must be different than the first form of identification for each caller. The claim language also requires that this second piece of information contain something "personal" by way of identification, that is, data that is assigned to a person or identifies a person as an individual as opposed to a customer of a merchant or vendor. Nothing in the claim language instructs that this second piece of identification cannot be a *personal* identification number (PIN) or an expiration data from a credit card as long as the data identifies the individual. The prosecution history cited by the defendants does not require that the Court adopt the defendants' construction either; Katz did not state in the Amendment that his system would not accept a PIN as a form of personal identification.

Thus, based on the claim language, the Court construes "caller customer number data" to mean: a number assigned to a customer by a vendor or merchant or recognized by a vendor or merchant for the purpose of identification of the customer. The Court construes "other distinct identification data element consisting of personal identification data" to mean: data that identifies a caller as an individual which is distinct from customer number data.

f. "Means for Selecting"

[29] The parties agree that the term "means for selecting" is subject to means-plus-function analysis. This term appears in Claim 104 of the '707 patent, in dependant Claim 103. The function, which is set out in the claim language itself and described in Column 10, lines 34 through 43 of the '707 patent, that is performed by the "means" is selecting a specific one of a plurality of formats based on the called number. In Column 4, lines 52 through 59, the specification of

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works

the '707 patent discloses that the "interface 20 incorporates ... DNIS ... capability (call data analyzer 20a)." As explained in line 62 of the same column through line 2 of Column 5, "DNIS" is a function of the communication facility which provides data indicating the called number and may be used with the interface 20 and call data analyzer 20a.

The defendants contend that the Automatic Call Distributor AC1, the Interface 20, and the Switch 21 correspond to the "means" in "means for selecting." However, the specification at Column 6, lines 37 through 48 indicates that the ACD merely receives the call signal from the caller and "associates" the called number through the interface and the switch to the specific processor that contains the particular format associated with called number. Similarly, in Column 10, lines 31-43, the specification ***607** discloses that the communication facility couples the caller at the remote terminal to the correct processor to run the format selected by the called number through the ACD, the interface, and the switch. These passages do not specify which of these structures is performing the specific function of *selecting* the format based on the called number, as opposed to connecting the caller to the correct processor once the format has been selected.

The portion of the specification cited above from Columns 4 and 5 more clearly identifies that the interface and the CDA are the structures which perform the disclosed function. Thus, the Court concludes that the disclosed structure that corresponds to the "means" in "means for selection" is the Interface 20 and the Call Data Analyzer 20a in Figure 1. The ACD and the switch do not correspond to the means.

g. "Switching Structure"

[30] The term "switching structure" appears in Claims 49 and 50 of the '863 patent, and in context reads "switching structure coupled to said interface structure for switching certain select ones of said individual callers at said remote terminals to any one of a plurality of live operators wherein said live operators can enter at least a portion of said caller data relating to said select ones of said individual callers through interface terminals, which is stored in said record structure."

The plaintiffs contend that this term is not subject to means-plus- function analysis because the term "switch" is well known to those experienced in computer telephony and it brings to mind structure to those of skill in the art. The plaintiffs argue that switching structure should be defined as "hardware with associated software used to route calls." (Pls.' Appendix at 164).

The defendants contend that the term "switching structure" is subject to analysis under § 112, ¶ 6 because the term lacks a sufficiently definite structure such that one of skill in the art would not know what structure to build without more information than is provided in the claim. The defendants argue that in the passages that discuss the switching structure, including Column 5, lines 51-55; Column 7, lines 13-17; Column 10, lines 45-52; and Column 11, lines 8-12 of the '863 patent, Katz did not disclose structure to perform the entire function performed by the means, which is switching callers to a live operator, where the live operator enters caller data for storage in the record structure.

During the *Markman* hearing, all of the experts referred to "switches" in their discussion of computer telephony at the time of the Katz patents. Similarly, the term "switch" was often used in contemporary references and prior art referred to by the parties at the hearing. The Court concludes that, based on these examples of the state of the art and the testimony of the experts, the term "switching structure" does not implicate § 112, ¶ 6. The Court concludes that the term would have connoted a specific set of structures to those of ordinary skill in the art. Thus, based on the claim language and the specification, the Court construes the term "switching structure" to mean: a device including hardware and associated software that can switch or route telephone calls or signals from one location or connection to another.

h. "Record Testing Structure"

[31] The term "record testing structure" appears in Claim 192 of the '707 patent. The limitation in full provides for a "record testing structure connected to receive and test said caller data signals including said calling number identification data and said caller personal identification data against previously stored calling number identification and caller personal identification data."

The plaintiffs argue that this term is not subject to means-plus-function analysis because it would have called to mind sufficient structure to those of ordinary skill in the art. The plaintiffs propose that the Court construe "record testing structure" to mean "a hardware device, with associated***608** software, used to store information and implement tests based on that information." (Pls.' App. at 155).

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works

The defendants argue that "record testing structure" is subject to § 112, ¶ 6. The structures the defendants contend corresponds to the function performed by the record testing structure are the Processing Unit 96, the Qualification Unit 93, the Buffer Storage 97, either the Look-up Table 99 or the Use Rate Calculator 100, and the logic within the qualification unit to receive information regarding the calling number from the interface. Further, the defendants argue that the structure corresponding to "record testing structure" cannot be any computer with any type of memory; if this were the case, the defendants argue, § 112, ¶ 6 would have no meaning. The defendants contend that the processing unit must be programmed to receive decoded personal identification data from the callers and to test it against stored data for the callers.

The Court concludes that "record testing structure" implicates § 112, ¶ 6 because "record testing" is clearly a functional term and it does not connote any structure for performing the function of receiving and testing said caller data signals including said calling number identification data and said caller personal identification data against previously stored calling number identification and caller personal identification data. The Court concludes that the structures disclosed in the specification that correspond to "record testing structure" are the Processing Unit 96, the Qualification Unit 93, and the Look-Up Table 99 in Figure 4. *See* Column 10, lines 1 through 25 of the '707 patent. Contrary to the defendants' contentions, the described functions of the Use Rate Calculator 100 and the Buffer Storage 97 in Column 10, lines 1 through 25 of the '707 patent are not required to perform the function of receiving and testing signals against stored data called out in the claim. Thus, these structures do not correspond to record testing structure.

3. "Processing"

[32] The next term the parties presented to the Court for construction from the Analysis Control System patents is "processing." In Claims 104 and 117 of the '707 patent, the term appears in context as "means for processing at least certain of said data developed by said terminals and said calling number identification data relating to certain select ones of said individual callers." In Claim 192 of the '707 patent, the terms appears in context as "analysis structure for receiving and processing said caller data signals under control of said record testing structure." The final analysis control system claim at issue in which "processing" appears reads "means for processing at least certain of said data developed by said remote terminals relating to certain select ones of said individual callers." Claim 171 of the '863 patent.

The parties agree and the Court concludes that the phrase "means for processing" is a means-plus-function limitation subject to § 112, ¶ 6. The structures corresponding to the "means" in "means for processing" include the Processing Unit 92 in Figure 4, the Central Processing Unit 251 in Figure 9, or the Processors PR1 through PRn in Figure 1.

The defendants argue that the term "analysis structure" in "analysis structure for ... processing" is also subject to means-plus-function analysis. To support their position, the defendants contend that in the '739 patent, which shares the same specification as the '707, '863, and the '309 patents, Katz used the term "analysis means" in limitations similar to the limitations which contain "analysis structure." The plaintiffs contend that "analysis structure" had meaning to those in the art and connoted computer hardware and software used to analyze data, such as a processor. (Pls' App at 160-61). The Court concludes that the term analysis structure is written in functional language and does not connote sufficient structure to avoid the application ***609** of § 112, ¶ 6, despite the presumption to the contrary. The function of the analysis structure in the terms of the claim language is "receiving and processing said caller data signals under control of said record testing structure." The structures that correspond to "analysis structure" are the same as those that correspond to the "means" in "means for processing," i.e., the Processing Unit 92 in Figure 4, the Central Processing Unit 251 in Figure 9, or the Processors PR1 through PRn in Figure 1.

The core dispute between the plaintiffs and defendants is whether "processing," as used in "means for processing" or otherwise in the patents, requires a specific type of processing. The defendants contend, in the context of their means-plus-function arguments, that the structures that correspond to the "means" in "means for processing" also include the software that performs the function of processing, and because the only type of processing disclosed in the specification is statistical analysis to isolate a subset of callers in the context of the specific formats disclosed, the computer must be programmed with software that performs this particular kind of processing. Specifically, the defendants argue that all of the disclosed formats in the specification, including a health poll format, mail order format, instant lottery format, auction sale

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works

format, television game show formats, and television poll format, require the use of statistical analysis to isolate a subset; thus, they argue, "processing" and "statistical analysis" are synonymous. The defendants also argue that if the term "processing" is given a broad, unlimited meaning, it would render other limitations that call out specific functions of a computer surplusage, such as "accessing" a file, "storing" data, and "testing" data.

The plaintiffs argue that the defendants' proposed construction of "processing" has no support in the claim language, and that the defendants are attempting to define the function of "processing" by importing structural limitations from the specifications. The plaintiffs argue that the term should be given its ordinary meaning, which is "performing some operation or sequence of operations on data and/or telephone calls." (Pls.' Appendix at 7).

The term "processing," even as part of the phrase "means for processing," is not subject to means-plus-function analysis, so an immediate resort to the specification for meaning is not appropriate unless there is some "hook" in the claim language on which limitations from the specification may be hung. *See Renishaw*, 158 F.3d at 1252. Thus, if the term "processing" in the context of the claim language had a common, ordinary meaning to those of ordinary skill in the art, that meaning is the proper construction of the term, even if it is broad. *See Johnson*, 175 F.3d 985, 989.

Contemporary technical dictionaries indicate to the Court that "processing" had a broad meaning to those of skill in the art for some time. In the context of these claims it is clearly implied that the processing is being performed on data. The *Standard Dictionary of Computers and Information Processing* by Martin H. Weik (1969) defines the verb "process" as follows: "In data processing, to handle, manipulate, or perform some operation or sequence of operations on data in accordance with a specified or implied algorithm, usually as a series of discrete steps, including operations such as compute, assemble, compile, interpret, generate, translate, store, retrieve, transfer, select, extract, shift, search, sort, merge, transliterate, read, write, print, erase, and punch. The processing usually results in a solution to a problem." (Ex. 458). In the *Computer Dictionary*, by Charles J. Sippl (1966), the term "process" is defined as a "generic term that may include compute, assemble, compile, interpret, generate, etc." (Ex. 498). In the *Dictionary of Computing and New Information Technology*, by A.J. Meadows et al. (1984), the term "data processing" is defined as including "all clerical, arithmetical and logical ***610** operations on data. Data processing in the context of information technology always implies the use of a computer for these operations." (Ex. 483).

The claim language also shows that the term "processing" does not by itself indicate statistical analysis to isolate a subset of callers. Many claims, dependent and independent, in the '707, '863, and '309 patents specifically call out processing to isolate a subset of callers. For example, Claim 169 of the '707 patent specifically calls out processing to isolate a subset of callers. Claim 174 of the '863 provides for "subsequent" processing that isolates a subset of callers; however, Claim 171, upon which Claim 174 depends, does not require such a parameter on the initial processing. Similarly, Claim 181 of the '863 provides for "processing ... responsive to said approval signals." Claim 185 of the '863 patent, which is dependant on Clam 181, specifically provides for processing to isolate a subset callers. The fact that "processing" is called out in some claims, and then specifically "processing to isolate a subset of callers" is called out in other claims, some of which are dependant on the claims that call out "processing" generally, indicates that the independent claims which contain the term "processing" do not necessarily require that the processing perform statistical analysis to isolate a subset of callers or data. *See Rodime PLC v. Seagate Technology, Inc.*, 174 F.3d 1294, 1306 (Fed.Cir.1999). If the term "processing" were given the limited scope explicitly called out in the dependent claims, those claims would be rendered superfluous, a result that should be avoided if the claim language will allow under the doctrine of claim differentiation. *See Laitram Corp. v. Rexnord, Inc.*, 939 F.2d 1533, 1538 (Fed.Cir.1991). [FN18]

FN18. The defendants contend that under *Laitram*, claim differentiation does not apply to means-plus-function limitations; however, the term "processing" is the functional language of the claim and is not subject to means-plus-function analysis.

There is nothing in the specifications that requires the Court to alter the broad meaning of "processing" conveyed in the claims, even though the subject of statistical analysis to isolate a subset of callers is repeatedly discussed. The name of the patents under consideration is "Telephonic- Interface Statistical Analysis System." At several points in the

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works

specification, Katz describes his invention generally or one of the formats generally as performing statistical analysis to isolate a subset of callers. *See* Column 1, line 58-67 of the '707 patent (providing that "[i]n general, the present invention comprises a telephonic-interface system and related process ... in a variety of different interface formats or programs, as to ... statistically analyze acquired data, as in combination and is association with external data (time independent), and accordingly to isolate a subset of the callers with variable identification"); Column 2, line 22-26 of the '707 patent (providing that "in accordance with various formats, acquired data is processed in statistical relationship, or in relation to applied external data"); Column 5, lines 53-55 of the '707 patent (providing that "[i]n general, the processing evolves a subset (at least one caller) the members of which may be verified or confirmed"); Column 21, lines 33-38 (providing that "[i]n view of the above explanation of exemplary systems, it will be appreciated that other embodiments of the present invention may be employed in many applications to accumulate statistical data, process such data, and define subsets of callers of concern").

It is no surprise that Katz discussed statistical analysis to isolate a subset of callers in the specifications to the '707, '863, and '309 patents because he specifically called out this function in some, but not all, of the claims in those patents. Conversely, there is no mention in the specifications to the '285 and '150 patents of "statistical analysis" or "isolating a subset of callers" because none of the claims in those patents specifically call out such processing, even though the term "processing" ***611** appears in the claims of those patents. While the specifications of the '707, '863, and '309 patents call out several embodiments of the Katz invention in which processing is performed to isolate a subset of callers through statistical analysis, not all of the claims that contain the broad term "processing" require this limitation. Whether, as defendants argue, Katz's claims are broader than his disclosure in the specifications of his patents, is a question for another day and does not alter the construction of "processing," a term that clearly had a broad and common meaning to those of ordinary skill in the art.

The portions of the prosecution history highlighted by the defendants do not conflict with the common understanding of "processing." During the prosecution of the '968 patent, from which the patents-in-suit descended, Katz distinguished his invention from a collection of prior art in part on the basis that his invention variously incorporated "(1) personal participant selectivity, (2) participant record development and (3) analytical inter- related data processing with respect to developed records." (Ex. 33, March 2, 1988 Amendment at 14). The defendants argue that this statement by Katz indicates that all of his claims, including pending Claim 37 which did not explicitly call out "statistical analysis to isolate a subset," incorporate statistical analysis or "inter-related processing." However, pending Claim 38, which was dependent on Claim 37, added the specific limitation of "processing said statistical data as to isolate a subset of said individual callers." Katz's assertions during the prosecution of the '968 patent that his invention *variously* incorporated three elements does not require, and this Court will not, import the limitation of "analytical inter-related data processing" or "statistical analysis to isolate a subset" into the definition of "processing" in claims of the '968 patent, or of any of the patents at issue in the *Markman* hearing.

During the prosecution of the '923 patent, which has the same specification as the '707, '863, and '309 patents, Katz attempted to distinguish his invention from a patent to Riskin by stating that the Riskin patent did not "suggest any interrelated processing between callers, nor are processing files formed other than merely to accommodate billing." (Ex. 38). In an Appeal Brief dated September 11, 1992 during the same prosecution, Katz described his invention as systems that "statistically acquire data, as in combination with and in association with external data (time independent), and accordingly isolate a subset of the callers with verifiable identification." (Ex. 38). Similarly, in the Information Disclosure Statement dated January 31, 1996 at 13 during the prosecution of the '185 patent, Katz informed the PTO that "[i]n various applications, Applicant's inventive systems have utilized an operation of processing data to isolate a subset of callers. In a refined form, the operation involves processing data from callers in combination to isolate a select subset of the callers by 'interrelated' processing." (Ex. 56). These statements by Katz indicated that his patents suggest or include interrelated processing or statistical analysis to isolate a subset of callers, which is clear by the claims which explicitly call out this function. However, none of these statements by Katz indicates that any particular claim includes this type of processing or that all processing suggested in his patent is of this type.

Based on the foregoing, the Court construes the term "processing" to mean: manipulation of data which performs some operation or sequence of operations on the data.

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works.

4. "Format"

[33] The next term presented to the Court for construction is "format." This term appears in many of the claims at issue in the *Markman* hearing. For example, Claim 104 of the '707 patent provides for "[a] system according to claim ***612** 103, wherein said called number identifies a specific one of a plurality of operating formats for interface." Claim 192 of the '707 patent provides for "[a]n analysis control system according to claim 191, wherein said select called number (DNIS) identifies a select format from a plurality of distinct operating formats."

The plaintiffs contend that the term "format" as used in the patents had a common meaning to those of ordinary skill in the art, and they ask the Court to define "format" as "a computer program, including instructions and/or pre- recorded messages, for providing a service to callers." (Pls.' Appendix at 7).

The defendants argue that although the term "format" only explicitly appears in some of the claims, the concept of "format" is implicit in all of the claims and corresponds to the "analysis control system" that is called out in the claims under consideration. Arguing that the term is imprecise and ambiguous without reference to the specifications, the defendants contend that "format" is defined by Katz in the specification as analysis that isolates a subset of callers and should be limited to include only the seven formats disclosed in the specifications, including mail order, auction, health poll, television game show, television game show requiring participation numbers, lottery, and television poll formats. Alternatively, the defendants argue that if the Court does not limit "format" to the seven disclosed embodiments, it should define "format" by common threads present in all the formats disclosed; for example, the defendants contend that a format must include a data acquisition phase in which callers enter or are assigned data for processing, and a processing phase in which that data for multiple callers is statistically analyzed with like data for other callers or with common external data to isolate a subset of callers participating in the format.

Construction begins with the claim language, and the language here is instructive. Considering Claim 192 of the '707 patent, which is quoted above, it is clear that "analysis control system" and "format" are not the same concept, as the claim includes both terms and indicates that the format is only a part of the analysis control system.

The language of other claims which were not designated for the *Markman* hearing supports a construction of format that does not require statistical analysis and is not limited to the seven disclosed embodiments of the specifications. In some claims, Katz specifically limited the format in a claim to a particular type of format. For example, Claim 42 of the '707 provides for a "promotional format," Claim 45 of the'863 patent provides for an "order format," Claim 46 of the '863 provides for a "television initiated mail order operation," and Claim 56 of the'863 provides for a "merchandising format." The fact that these particular formats are called out in some of the claims indicates that the term "format" alone is not limited to any particular format or set of formats.

The specifications of the patents do not indicate that "format" must include statistical analysis or be limited to the disclosed embodiments. Although the Background and Summary of the Invention in the specifications to the '707, '863, and '309 patents describes the invention as generally performing certain functions, including statistically analyzing data, it does not explicitly require that the "format" include statistical analysis or that the "format" is performing the statistical analysis. *See* Column 1, lines 43- 47, 57-67 of the '707 patent; Column 2, lines 4-14, 22-26 of the '707 patent. In addition, the language of the Background and Summary of the Invention is exemplary; it provides what the invention is *generally* or what it *may* include or perform. *See* Column 1, lines 43 through 67 of the '707 patent. Similarly, in describing the seven disclosed embodiments of his invention, Katz repeatedly stated that the examples were illustrative or exemplary. *See, e.g.*, Column 9, lines 48 through 51; Column ***613** 11, lines 66 through 67; Column 12, lines 1 through 19 of the '707 patent.

Figure 3 of the '707, '863, and '309 patents is a flow diagram for one operating format of the Katz system. *See* Column 2, lines 44-45 of the '707 patent. The diagram illustrates a series of commands or instructions for the computer and the sequencing of those commands, including the content and sequence of voice prompts and the operations on data to be stored in or retrieved from memory. There is no indication in the figure of statistical analysis or that the format is limited to the disclosed embodiments. To limit the term "format" in these patents to the disclosed embodiments would violate the ruling of *Comark Communications, Inc. v. Harris Corporation*, 156 F.3d 1182, 1187 (Fed.Cir.1998) and similar cases.

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works

The prosecution history cited by the defendants does not support their proposed construction of "format." During the prosecution of the '023 patent, the examiner rejected certain of Katz's claims as anticipated by a patent to Riskin because the Riskin patent described various "formats," including stock quotation, movie directory, and product information services. (Ex. 48). Similarly, during the prosecution of the '120 patent, the examiner rejected certain of Katz's claims as being unpatentable over a group of references because the claims contained "game" or "operating process" formats that were selected through the use of the dialed number. These statements indicate that the examiner did not consider the Katz formats to be limited to the seven embodiments disclosed in the specifications because the examiner rejected some of Katz's claims as unpatentable over patents which contained "formats" other than the seven described by Katz. The defendants pointed to no statements by Katz during the prosecution of the patents in which he disclaimed coverage of any formats other than the formats discussed in the specifications.

Based on the foregoing, the Court construes the term "format" to mean: a computer program that sets forth the content and sequence of steps to gather information from and convey information to callers through pre-recorded voice prompts and messages.

5. "Multiple Formats" or "Plurality of Formats"

[34] The parties also disagree over the proper construction of the terms "plurality of formats" and "multiple format." [FN19] The plaintiffs argue that the terms "plurality" and "multiple" clearly had the common and plain meaning of "more than one" to one of ordinary skill in the art. The defendants do not contest that these terms mean "more than one," but rather they argue that because it is impossible to know whether a system is running on one format or more than one format, "multiple" or a "plurality of" formats must have three characteristics. First, each format must be a separate computer program and not just different questions or branching in the same format. Second, each format must have distinctly different subject matter and functionality. Third, each format must be reached by a different and unique called number.

FN19. These terms appear in the Conditional Format Claims at issue in the '150 and '285 patents and the Participation Number claims at issue in the '707 and '863 patents.

The plaintiffs agree that subroutines or branching within a format do not constitute multiple formats. The specification of the '707 patent confirms this. *See* Column 18, line 37 (noting in the context of the television game show format that "the basic format can remain the same, only the questions change by time zone"). The plaintiffs also agree that one phone number cannot be used to reach different formats. The specifications support this understanding of "multiple formats" or "plurality of formats." *See* Column 12, lines 5-6 (noting that one of the common structural elements of the Katz invention is "utilizing the called number to select a ***614** specific operating format"). However, the patents do not support the defendants' contention that each format of a plurality of formats or multiple formats must be assigned a unique called number.

The patents also do not support the defendants' contention that each format in a plurality of formats or in multiple formats must be different in the function it performs or in subject matter. In the '150 patent specification, Katz states that "[e]xemplary selected formats of the processor might include: public polls, lotteries, auctions, promotions, sales operations and games;" the use of plural to describe the formats indicates that the processor could run more than one of any type of format. Column 2, line 65 to Column 3, line 1 of the '150. Thus, if a processor is running a series of formats, even if all are lotteries or all are mail order formats, this would constitute a "plurality of formats" or "multiple formats."

The prosecution history cited by the defendants does not dictate that the Court should alter the construction of "multiple formats" or "plurality of formats" that is clear from the claim language and specifications. In an Amendment dated January 11, 1990 during the prosecution of the '506 application, Katz amended one of his claims to recite "a plurality of distinctly different operating process formats." (Ex. 36). However, the examiner subsequently rejected this claim as amended, and this particular language does not appear in any of the claims at issue. During the prosecution of the '150 patent, Katz noted in an Amendment dated October 5, 1989 that the patent to Riskin "contains no suggestion of a multiple format processor nor structure for conditioning accepted calls." [FN20] (Ex. 35). The Court concludes that Katz was not limiting the term "multiple format" to require formats with different subject matter or functionality in this statement to the PTO.

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works

FN20. Katz made a similar statement in an Amendment dated June 30, 1992 during the prosecution of the '285 patent. (Ex. 50).

Based on the foregoing, the Court construes the terms "plurality of formats" and "multiple formats" to mean: more than one format. The terms do not include the subroutines or branching within a single format.

6. "Remote Terminals"

[35] The parties dispute the meaning of the term "remote terminals," which appears in claims throughout the body of patents to Katz. The parties agree that the term refers to traditional telephones, but the plaintiffs contend that the term may comprise other devices as well, such as wireless phones or a computer that can access the telephone network.

The plaintiffs contend that a person of ordinary skill in the art reading the Katz patents would understand that "remote terminals" could refer to devices other than traditional telephones. The defendants argue that there is no support in the specifications for any device other than traditional telephones.

The claim language in the patents does not support the defendants limited definition. Claim 96 of the '707 patent is exemplary of many of the claims that contain the term "remote terminals." Claim 96 provides for "[a]n analysis control system for use with a communication facility including remote terminals for individual callers, wherein each of said remote terminals may comprise a conventional telephone instrument including voice communication means and digital input means in the form of an array of alphanumeric buttons for providing data." The use of the words "*may* comprise" indicates that remote terminals includes, but is not limited to, traditional telephones.

The specification does not limit "remote terminals" to conventional telephones only. In Column 3, line 55 through Column 4, line 18 of the '707 patent, Katz describes ***615** the remote terminal illustrated in Figure 1. Although Katz describes what would be considered a traditional or conventional telephone, the specification is clear that the remote terminal in Figure 1 is the illustrative embodiment and that the description of it is exemplary.

The prosecution history cited by the defendants does not restrict the definition of "remote terminals." In the prosecution history of the '968 patent, in an Amendment dated March 2, 1988, Katz attempted to distinguish his patent from other patents containing, among other devices, "a special form of terminal apparatus at a data source" by noting that "[c]ontrary to the operations of the systems described in the above references, applicant's system interfaces with a *conventional telephone instrument.*" (Ex. 33). Katz went on further to explain regarding "special-purpose telephone instruments" that "[c]learly, such telephones could be employed in cooperation with applicant's system; however, a very significant feature of applicant's system is its ability to function cooperatively with a conventional telephone instrument. Accordingly, specific forms of transaction telephone instruments or data phones are not deemed to be particularly applicable to the claims as set forth herein...." Contrary to the defendants' contention, the Court concludes that this statement by Katz indicates that his system could accommodate conventional telephones, as well as other devices, not that it was limited to use with conventional telephones.

Thus, the Court concludes that there is nothing in the claim language, specifications, or prosecution history that indicates that "remote terminals" can only include conventional or traditional telephones and not wireless phones or computers connected to the telephone network. Based on the foregoing, the Court construes "remote terminals" to mean: a device or instrument for connecting callers to the telephone network for voice and digital communication, including, but not limited to, conventional telephones.

7. "DNIS" and "called number identification data"

[36] The next terms the Court must construe are "DNIS" and "called number identification data." These terms appear in many of the Analysis Control System claims, including Claim 104 of the '707 patent which reads "a system according to claim 96 for use with a communication facility having a capability (DNIS) to provide called number identification data to identify a called number from a plurality of different numbers for calling," [FN21] Claim 192 of the '707 patent which reads "an analysis control system according to claim 183, wherein said communication facility automatically provides called number identification data (DNIS) to identify a select called number from a plurality of called numbers," and Claim 65 of the '863 patent which reads "an interface structure ... including means to automatically receive call number identification

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works

signals (DNIS) to identify a select format from a plurality of formats." [FN22]

FN21. This language is found in Claim 103 of the '707 patent, upon which Claim 104 depends.

FN22. The terms "DNIS" and "called number identification data" appear in claims other than the Analysis Control System claims; the parties agree and the Court concludes that the terms have a uniform meaning across all of the claims at issue.

The parties agree that the terms "DNIS" and "called number identification data" have the same meaning and are used interchangeably in the patents. The plaintiffs contend that the terms mean "a signal representative of the number called."

The defendants argue that DNIS or called number identification data must represent the full dialed number, which is seven or ten digits. The defendants also contend that DNIS or called number identification data cannot be internal routing ***616** numbers or vector directory numbers; because the claims indicate that the communication facility provides DNIS or called number identification data *to* the interface and the interface *receives* DNIS or called number identification data *from* the communication facility, the defendants argue that DNIS or called number identification data cannot be any signal sent internally in the communication facility.

The Court concludes that the terms "DNIS," "called number identification data," and like terms have the same meaning and are used interchangeably in the patents. The term "DNIS" is an acronym for "dialed number identification service." Both "dialed number identification service" and "caller number identification data" contain the word "identification," and the plain import of these phrases is a signal or data that identifies the number that has been called. Thus, the language of the claims does not support the defendants' argument that "DNIS" or "called number identification data" must be the full seven or ten digit dialed number. The claim language does not support the defendants' argument that "DNIS" or "called number identification data" cannot include internal routing numbers within the telephone network; indeed, such numbers are neither mentioned in nor relevant to the Court's construction of the claims at all.

The passages of the specifications to which the defendants point do not support the limited construction proposed by the defendants either. In Column 12, lines 2 through 6 of the '707 patent, Katz describes one of the structural elements that have reoccurring significance in his inventions as "utilizing the called number to select a specific operating format." The defendants emphasize that Katz lists a ten or seven digit number as an example of the called number in the specifications; in Column 6, lines 41-45 of the '707 patent, Katz explains that "[r]eceiving the call signal, the automatic call distributor AC1 associates the called number ((213) 627-3333, rendered available using standard telephone DNIS techniques) through the interface 20 and the switch 21 to attain connection with the specific processor...." However, the mere reference to "called number" does not restrict "called number identification data" to a certain number of digits, nor is there reason to restrict the terms "DNIS" and "called number identification data" to the examples provided by Katz in the specifications.

Further, in Column 4, lines 62 through 64 of the '707 patent, Katz stated that "[g]enerally, DNIS capability is a function of the communication facility C (composite telephone system) to provide called terminal digital data indicating the called number." "Data indicating the called number" undermines the defendants contention that the data must be the full dialed number. Similarly, in Column 10, lines 39 through 42 of the '707 patent, Katz stated that "[n]ote that the communication facility C provides the dialed number ("(213) 627-4444") to the processing system P1 through well known telephonic equipment DNIS." These passages confirm that DNIS or called number identification data must only be a signal that identifies the called number and need not be only the seven or ten digit number.

The prosecution history cited by the defendants does not alter the meaning of the terms conveyed by the claim language and specifications. The first set of statements by Katz in the prosecution history, the defendants argue, indicates that DNIS or called number identification data must be the full dialed number. In an Information Disclosure Statement dated September 20, 1994 submitted during the prosecution of the '285 patent, Katz attempted to distinguish his claims from a group of patents and other references. (Ex. 50). Katz described the '012 patent to Matthews et al. as a "system identified as Direct Inward Dialing or 'DID,' which involves the capability of utilizing the last three or four digits of a

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works

called number for routing to a desired recipient's telephone" and distinguished ***617** the system as "quite different from the combinations set forth in the claims in that, neither DNIS signals were utilized nor were formats selected. Additionally the system was void of either qualification or operator control...." [FN23]

FN23. Katz made an almost identical statement regarding the Matthews patent to the PTO in the prosecution of the '734 patent. (Ex. 61).

Similarly, in a Supplemental Amendment dated March 14, 1995 during the prosecution of the '734 application, Katz also distinguished the '906 patent to Matthews on the basis that the Matthews system "utilizes so called 'DID' signals for accessing an individual program.... However, again, the structure and operation is distinct from Applicant's techniques utilizing DNIS for format selection and further involving testing." (Ex. 61).

It is unclear from these two statements however, whether Katz was basing his distinction on the difference between the number of digits or content of a DID signal versus a DNIS or caller number identification data signal, or if he was basing his distinction on the different *functions* that those signals performed. What is clear is that Katz did not explicitly state that DNIS or called number identification must include all of the digits of the number dialed.

The second set of statements by Katz in the prosecution history, the defendants argue, indicate that DNIS or called number identification data cannot be internal routing numbers in the telephone network. In the September 20, 1994 Information Disclosure Statement, Katz described the '682 patent to Vij et al. as "another utilization of 'DID' operation to route calls. Again, the operation is quite distinct from DNIS operation and is further distinguished from the claims herein on the basis of testing, computer interface and so on." [FN24] (Ex. 50). In the same Information Disclosure Statement, Katz described the '500 patent to Binkerd et al. as "another alternative for routing calls utilizing inputs by a caller. Again the system is quite distinct from the utilization of DNIS capability." (Ex. 50). During the prosecution history of the '075 patent in the Preliminary Amendment dated July 17, 1990, Katz stated that "[r]ecognizing that the Riskin patent discloses the utilization of ANI and DNIS signals to accomplish telephone routing, it is respectfully submitted that applicant's system involves entirely different philosophical considerations and structure. The provision of an interface system utilizing these signals, not only to select an operating format but further to accomplish associative data, is submitted to involve a patentable distinction." (Ex. 40). In an Amendment dated August 31, 1995 during the prosecution of the '707 patent, Katz attempted to distinguish the '336 patent to DeBruyn for an international lottery system on the basis that the system indicated direction or routing to different processors for individual language operation in response to different dialed numbers, but "no suggestion of DNIS appears nor is the system otherwise pertinent." (Ex. 51).

FN24. Katz made an almost identical statement regarding the Vij patent to the PTO in the prosecution of the '734 patent. (Ex. 61).

These statements indicate that Katz distinguished his inventions from other patents on the basis of the comparative functions of the systems; the systems in the other patents use signals to route telephone calls, not select a format from a group of formats or to store data associated with those signals. However, Katz never informed the PTO that the same numbers that other systems used to route calls could not be used to identify the called number and select a format. In short, it is not clear from Katz's statements, contrary to the defendants' contention, that "internal routing numbers," to the extent they can identify the called number, could not be included in the meaning of called number identification data or DNIS, as used in the Katz patents.

***618** Based on the foregoing, the Court concludes that the terms "DNIS" and "called number identification data" are synonymous and mean: a signal or data that identifies the number called.

8. "ANI" and "Calling Number Identification Data"

[37] "ANI" and "calling number identification data" are the next terms presented to the Court for construction. In general, the term "calling number identification data" appears in the claims and the term "ANI" is used in the specifications. The parties agree that "ANI" and "calling number identification data" have the same meaning.

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works

In the Analysis Control System Claims, the term "calling number identification data" appears in context as "receiving said calling number identification data." *See* Claims 33, 104, 117, and 192 of the '707 patent and Claim 171 of the '863 patent. In the Conditional Format claims, the terms appear in context as "call data signals as to indicate ... calling numbers" or "calling numbers as additional call data signals." *See* Claim 15 of the '150 patent and Claims 17 and 24 of the '285 patent. In the Products Carrying Participation Numbers Claims, the terms appear in context as "call data signals indicative of calling number identification data." *See* Claim 44 of the ' 707 patent and Claim 79 of the '863 patent. These terms appear throughout the Katz patents. The parties agree and the Court concludes that the terms have a consistent meaning across the claims at issue.

The arguments of the parties regarding the proper construction of these terms mostly mirror their arguments regarding "DNIS" and "called number identification data." The plaintiffs argue that these terms mean a signal provided by the telephone network that indicates all or part of the calling number. (Pls.' Appendix at 31, 69). The defendants argue that "ANI" and "calling number identification data" must refer to the entire calling number, do not include routing or billing signals used within the telephone network, and must identify the geographic location of the caller such that wireless phones are excluded. The arguments of the defendants will be addressed in turn.

There is no indication in the claim language that "ANI" or "calling number identification data" must be the full calling number; indeed many of the claims call out a signal that *indicates* the calling number. The specifications do not support the defendants' contention either. In Column 4, lines 62 through 67 of the '707 patent, Katz notes that "ANI capability is a similar function whereby the digital data indicates the calling number with calling terminal digital signals." The defendants contend that because Katz used ten digit phone numbers in his examples in the specifications, the terms "ANI" and "calling number identification data" must include the full seven or ten digit number. In Column 6, lines 62 through 65 of the '707 patent, Katz describes two ways in which the calling number could be transmitted to the Katz system; he notes that "the caller would push the buttons in sequence to indicate his telephone number, e.g. '(213) 627-2222.' Alternatively, the interface 20 can accept the calling number ((213) 627-2222) according to its provision by standard ANI equipment of the communication facility C." In Column 7, lines 29 through 30 of the '707 patent, Katz notes that "the first portion, section 53, contains a form of identification data, i.e., the caller's telephone number, i.e. '(213) 627-2222."

The first passage of the specifications cited by the defendants is provided as an example of a calling number. It is clear that the number from which a caller is calling would be a full seven or ten digit number; however, the specification is silent about what the *signal* that conveys this number, the ANI or the calling number identification data, would include. The second passage of the specifications cited by the defendants describes an example of ***619** data that is stored in a cell as represented in Figure 2, not "ANI" or "calling number identification data." Neither of these passages indicates that "ANI" or "calling number identification data" must include any particular number of digits.

As for the defendants' second argument, the claim language does not support a construction of "ANI" or "calling number identification data" that excludes routing signals or billing signals that are used within the telephone network. This argument is essentially the same as the defendants' argument that "communication facility" means that the Katz system must operate outside of the telephone network, which the Court addressed above and will not repeat here. In short, neither the claim language nor specifications mention routing or billing signals as either included or excluded in the definition of "ANI" or "calling number identification data." Determining whether routing or billing signals are signals which indicate the calling number is not a matter of claim construction, and as such, is not properly before the Court.

Further, the prosecution history cited by the defendants neither confirms their proposed construction of "ANI" or "calling number identification data" nor conflicts with the plain meaning of the terms "ANI" and "calling number identification data" conveyed by the claim language and specifications. In an Amendment dated April 15, 1996 in the prosecution of the '751 patent, Katz attempted to distinguish the '020 patent to Fodale to support his amendment. Katz described the Fodale patent as providing a system which blocks delinquent telephone terminals from making toll calls by comparing routing and billing information provided by the local telephone office against a list of delinquent terminal numbers. Katz notes that in one arrangement in the Fodale patent, ANI provides the calling or billed number. Katz stated that "[n]o reference to ANI can be located in providing the

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works

caller number, which presumably is otherwise available to the local toll network." (Ex. 67). The defendants contend that Katz was referring to "his" version of ANI in this last statement and distinguishing signals that are sent outside the telephone network from the billing signals or routing signals that are internal to the telephone network. The defendants' interpretation of this statement by Katz is inconsistent with his statement that Fodale uses ANI to provide the calling or billed number in one arrangement. While the meaning of Katz's statements in this Amendment is not completely clear, the Court concludes that these statements clearly do not convey the message that the defendants would attribute to them, that Katz was disclaiming coverage of routing and billing signals.

As for the defendants' final argument, there is no requirement in the claim language that "ANI" and "calling number identification data" must identify the geographic location of callers. The defendants argue that the "ANI" and "calling number identification data" must disclose the geographic location of the caller because the formats disclosed in the specifications use ANI to screen callers based on their geographic area. In his description of a television game show format in Column 18, lines 37 through 44, lines 56 through 62 of the '707 patent, Katz proposes that different questions be used for different geographic locations to accommodate the different time zones and that "area code numbers afford an effective geographic classification of callers." In the context of the discussion of a television poll format in Column 20, line 16 through 22 of the '707, Katz proposes that callers may be screened by geographic area according to their telephone number which is provided by ANI equipment. The defendants contend that because Katz uses the geographic location of the callers taken from the calling number in these formats, the Mobile Identification Number or MIN supplied by wireless phones cannot constitute "calling number identification data" or "ANI" because MIN does not supply an ***620** accurate indication of the callers geographic location. However, in the discussion of an instant lottery format in Column 12, lines 46 through 47 of the '707 patent, Katz proposes the use of a caller's telephone number and date of birth to qualify a caller based on his age; in this example, the calling number is not used to qualify a caller based on his geographic location. Similarly, Claims 165 and 175 of the '707 patent call out the use of calling numbers for purposes other than determining geographic limitations. To adopt the defendants' construction of the terms at issue to always require the identification of the geographic location of the caller would not only improperly limit the claims by the examples disclosed in the specifications, but also would limit the claims in a manner inconsistent with some of the other examples in the specifications. The Court concludes that there is no basis in the claim language for importing such a limitation.

Based on the foregoing, the Court concludes that "ANI" and "calling number identification data" are synonymous in the claims at issue in the Katz patents and mean: a signal that identifies the calling number, i.e. the number from which a call originated.

9. In-band or Out-of-band Signaling

[38] The defendants have requested that the Court determine whether the patents require the signals indicating the called and calling number as just discussed to be transmitted "in-band," or along a voice channel in the form of analog signals, and not "out-of-band" via an Integrated Services Digital Network (ISDN) connection. The plaintiffs contend that the patents are silent on whether the signals must be transmitted, or in-band or out-of-band, and thus no particular manner of connection or mode of transmission of these signals is required.

The parties presented expert testimony and argument on the difference between in-band and out-of-band signaling. In short, a signal carrying data may be transmitted over a telephone connection that travels in the same channel or line as the voice signal travels; such a data signal is said to be traveling "in-band." Traditional telephone connections are set up in this manner. A signal carrying data may be transmitted over a telephone connection in a channel or line that is separate from the channel or line that the voice signal travels; such a data signal is said to be traveling "out-of-band." An ISDN connection, which provides two voice channels and one data channel in the same connection, is an example of "out-of-band" signaling. A T1 connection provides for 24 channels or lines in the same connection; a data signal may travel in-band with each of the 24 voice channels or out-of-band in one of the channels along with the other 23 voice channels. (*See* Defendants' Demonstrative Exhibit 36).

To support their argument that the patents require in-band signaling, the defendants contend that the limitation in Claim 96 of the '707 patent which reads "means to provide signals representative of data developed by said remote terminals and for receiving said calling number identification data" is a means-plus-function limitation, and therefore, the Court must determine the structure disclosed in the

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works

specification that corresponds to the "means." [FN25] The defendants contend that the only structure disclosed in the specifications is an in-band connection. For support for this argument, the defendants rely heavily on Figure 1 in the '707, '863, and '309 patents. Figure 1 illustrates one hundred calls or lines coming into the Automatic ***621** Call Distributor AC1, fifty lines coming from the ACD to the Interface 20, and fifty lines coming out of the Interface 20. *See also* Column 4, lines 24 through 27 and Column 5, lines 3 through 13 of the '707 patent. The defendants contend that if Katz contemplated that the call data signals would be sent out-of-band, he would have had to show 51 lines going into and coming out of the Interface to allow for the separate data line in an ISDN connection. The defendants contend that Katz's disclosure of in-band signaling in Figure 1 is the structure to which the "means" corresponds. However, Figure 1 is an illustration of how the Katz system may be set up. Even assuming that the defendants' contention regarding the figure is correct, the Court concludes that Figure 1 does not require that the signals be sent in- band; it only illustrates that the signals *may* be sent in-band.

FN25. The defendants also contend that ANI or calling number identification data, and DNIS, or called number identification data signals, even in claims which are not in means-plus-function form, refers to in-band signaling only. However, to support this position, the defendants point to the same claim language and passages of the specification that they rely on to support their means-plus-function argument. Thus, the Court will treat these two issues together.

In addition, the defendants point to Column 4, lines 52 through 58 of the '707 patent, which indicates that the interface for receiving ANI may be a Centrum 9000 or an interface which includes tone decoders. The defendants contend that such interfaces could only receive analog in-band signals, not digital or ISDN signals. However, even assuming that this representation about the capacity of these interfaces is true, the types of interfaces provided in the specifications are exemplary only; they do not indicate that the signals can *only* be sent via one of these interfaces or that the signals can *only* be sent in-band.

In Column 4, lines 52 through 58 of the '707 patent, Katz notes that "the interface 20 incorporates modems, tone decoders, switching mechanisms, DNIS and ANI capability (call data analyzer 20a) along with voice interface capability." It is clear that the tone decoders and the DNIS and ANI capability of the call data analyzer perform the function of providing and receiving signals from the remote terminals and the communication facility. Thus, the Court concludes that the structures that correspond to the "means" are the Interface 20 and the Call Data Analyzer 20a.

The plaintiffs note that Claim 15 of the '150 patent, a process claim, recites the limitation of "receiving said call data signals from said telephonic communication system for a calling remote terminal," which is not written in means-plus-function form. They argue that the language of this claim in no way indicates the type of line on which the call data signals must be received and because it is not a means-plus-function limitation, it is not appropriate to import structure from the specifications. The Court agrees. In the specification of the '150 patent, in Column 4, lines 12-17, Katz discusses the call data referred to in his claims. The only requirement of the call data signals set forth in the specification pertains to the content of the signal: it must convey the called and calling number. There is no requirement in the specifications that the signals be sent in a certain manner or over a certain type of line or connection.

The patents are silent as to whether the call data signals must be transmitted "in-band" or "out-of-band." Thus, the Court concludes that the claims at issue do not require or exclude any particular manner of transmission or type of signaling.

10. "Consumable Participation Key" and "Limits on Use"

[39][40] The parties have presented the terms "consumable participation key" and "limits on use" to the Court for construction. "Consumable participation key" appears in Claim 51 of the '309 patent and reads in context "qualification structure controlled by said record structure for testing caller data signals provided by a respective one of said individual callers to specify a consumable participation key for restricting the extent of access to said system to limit data stored from said respective one of said individual callers on the basis of entitlement." The term also appears in Claim 65 of the '863 patent and ***622** reads in context "qualification structure for testing caller data signals provided by at least one of said individual callers to specify a consumable participation key, said consumable participation key for use during a single

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works

predetermined period of time for restricting the extent of access to at least a portion of said system by said one of said individual callers on the basis of entitlement."

The term "limit on use" or "limits on use" appears in Claims 33, 44, and 93 of the '707 patent and Claims 79 and 190 of the '863 patent. Claim 33 of the '707 patent recites in part a "qualification structure controlled by said record structure for testing said calling number identification data to specify a basis for entitlement defining a limit on use, for restricting the extent of access to said system for a respective one of said certain of said individual callers.... An analysis control system according to claim 26, wherein said limit on use relates to a dollar amount." The other claims in which "limits on use" appears are substantively the same; Claim 44 of the '707 is representative and reads "providing products carrying participation numbers specifying limits on use to entitle individual callers to access said operations of the interface with said telephonic communication system."

The parties agree that "consumable participation key" should be defined as a number or word that allows a caller access to a service or part of a service a predefined limited number of times and which cannot be refreshed or recharged. While the ordinary meaning of the claim language gives some indication of the meaning of "consumable participation key," the specification makes it clear. In Column 9, lines 31 through 35 of the '707 patent, the specification provides that "[f]or example, a list may be preserved by a use- rate calculator to implement a consumable key operation. That is, a user is qualified to a specific limited number of uses during a defined interval."

The parties disagree, however, on the meaning of "limits on use." The plaintiffs argue that "limit on use" means "a control imposed on the degree or extent to which callers may avail or utilize a service or one or more operations of a service." (Pls.' App. at 74). The plaintiffs contend that a limit on use can be any one of a range of restrictions including "limits based on the total number of permitted accesses, the time of day for permitted accesses, limits on use based on a dollar value, [and] limits on use based on a predetermined period of time." (Pls.' App. 75-76). The defendants argue that this term has the same meaning as consumable participation key in that it is a control on the number of times a caller may enter a format in the Katz system. The defendants agree that a limit on use can be fixed by a set number of uses or a set dollar amount. However, the defendants argue that a limit on use does not perform a metering function in that it does not effect the duration of access to a format; consequently, it cannot disconnect a caller during a format for exceeding a set period of use.

The place to begin is the claim language. Claim 33 of the '707 patent provides for a limit on use that relates to a dollar amount. The plaintiffs argue that this Claim clearly shows that limit on use is not restricted to only the number of calls or accesses into the system. Although this claim does not explicitly recite that the limit on use would be a duration of time linked to the set dollar amount, e.g. $10.00 limit at $2.00 per minute, it does not explicitly recite that the dollar amount could only be linked to a set number of accesses, e.g. $10.00 limit at $2.00 per access.

The defendants argue that the limits on use are used to qualify callers for access to the operations of the interface, which necessarily has to occur before the caller enters into the Katz system. However, claim 44 of the '707 patent provides for a further step of "invalidating on-line said participation numbers after said limits on use specified by said participation numbers are *623 reached." This claim calls out a step of utilizing the limit on use at a later point in the process after the qualification step.

The specification confirms that "limit on use" should not be restricted to set number of accesses to the Katz system. In Column 12, lines 52-57 of the '707 patent, Katz describes how a calling number may be "checked by the use- rate calculator to determine the number of times it has been used in excess of a predetermined number of calls *or dollar value* to participate in the lottery during a current interval of monitoring." (emphasis added). Similarly, in Column 12, lines 22 through 26 of the '707 patent, Katz describes how a lottery format may use a limit on use and states that "[f]or example, a person might be entitled to play the lottery a limited number of times or *to the extent of a limited dollar value* during a predetermined interval." (emphasis added).

Contrary to the defendants' assertion, the Court concludes that Katz does not equate all limits on use to consumable participation keys. In Column 9, lines 32 through 35 of the '707 patent, the specification provides that "a list may be preserved by a use-rate calculator to implement a consumable key operation. That is, a user is qualified to a specific limited number of uses during a defined interval." The use of the phrase "limited number of uses," which accurately describes a consumable

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works

participation key, does not indicate that all "limits on use" are consumable participation keys. Thus, it is clear from the claims and specifications that a consumable participation key is only one kind of a limit on use.

There is no indication in the Katz patents of a method of measuring a limit on use based on a dollar value. That is, neither the claims nor the specifications require that the limit on use based on a dollar value be decremented by the number of accesses to the system, ie. $2.00 for each access. The claims and the specifications leave open the possibility that the dollar amount could be decremented by some other method of measurement, such as time spent in the Katz system; ie. $2.00 for 10 minutes, such that the limit on use served a metering function.

The statements made by Katz in the prosecution history cited by the defendants do not require a different construction than what is clear from the plain language of the claims and specifications. During the prosecution history of the '707 patent, certain of Katz's pending claims, including pending claim 47, were rejected by the examiner in an office action as unpatentable over two patents and an article of Turbat. (Ex. 51). In an Amendment dated August 31, 1995, Katz amended pending claim 47 by substituting the phrase "one time use" with "limit on use." Katz also argued against the examiner's rejection of his pending claim 47 in a section entitled "Discussion of the Rejections of Claims 32, 37, 40, 41 and 47 under 35 U.S.C. § 103." In that section, Katz distinguishes the rejected claim 47 on the basis that "[a]pplicant's system, as claimed, is independent of both *time* (Barger and DeBruyn) and *value* (Turbat)." However, this discussion was clearly directed toward the rejection of the claim as originally written, which called for "a basis of entitlement defining a one time use," as evidenced by Katz's statement at the end of the discussion section that "[t]he rejected claims are urged to be distinct for the reasons presented above." Based on this review of the prosecution history, the Court concludes that Katz's statements about a claim that read "one time use" do not limit the claims that were eventually accepted, which read "limit on use."

Based on the foregoing the Court concludes that "consumable participation key" means: a number or word that allows a caller access to a service or part of a service a predefined limited number of times and which cannot be refreshed or recharged. The Court concludes that "limit on use" means: a control that limits a caller's access to a service based on some predetermined method of measuring the *624 level of use. The term "limit on use" is not restricted to a specific method of measuring use, such as a limited number of accesses into the Katz system.

B. CLAIMS INVOLVING PRODUCTS CARRYING PARTICIPATION NUMBERS

Claims Involving Products Carrying Participation Numbers are Claims 44 and 93 of the '707 patent and Claims 79 and 190 of the '863 patent. The text of these claims is set forth in the Appendix.

In general, these claims involve a method for limiting a caller's entitlement to access the functions of the system by requiring the caller to enter a participation number. These participation numbers are carried on products that are in some way provided to the caller prior to the call. The participation number corresponds to data stored in memory in the system which specifies a limit on a caller's access to the system.

1. "Products Carrying Participation Numbers"

[41] The plaintiffs contend that the term "products carrying participation numbers" is straightforward and its meaning may be taken from the ordinary meaning of the words themselves. The defendants argue that the words "product" and "carrying" indicate that the product on which the participation number is carried must have inherent value apart from the number; thus, the defendants argue, "products" cannot include prepaid calling cards.

The term "products" is not used in the Katz patents as a term of art, as the parties agree. Thus, the Court should give the term its plain, ordinary English meaning. The Court concludes that the plain meaning of "products," which denotes an item produced for use in a commercial setting, does not support the construction given to it by the defendants. The plain meaning of the term "product" in the claim language does not connote something of inherent value apart from the number carried with it.

The specification does not contradict the plain meaning of "products." The only place in the specification that discusses products carrying participation numbers is Column 17, lines 13 through 17 of the '707 patent, which reads "[a] key to participation in the game show may involve the purchase of a particular product. For example, a person desiring to participate may purchase a product which carries a concealed key number. The number serves as a caller's key to participation in the game

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works

show." This passage in no way suggests that the product must have value independent of the participation number. The defendants also point to Column 9, lines 35 through 38 of the '707 patent, which discusses restricting callers to the purchasers of a medical apparatus. This discussion is given by way of example only and does not indicate that all "products" must have inherent value apart from the participation numbers.

The defendants rely on statements made by Katz during the prosecution of the '707 patent. In the August 31, 1995 Amendment, Katz distinguished the '275 patent to Kamil by stating that "Kamil discloses a telephone system enabling prepayment for telephone calls, wherein special code and credit information is stored in memory in special exchanges and debited as the call progresses" and that Kamil "does not disclose specific limitation recitations including consumable key operation, nor does it disclose providing a product bearing a participation number specifying a limit on use." (Ex. 51). The defendants argue that Katz clearly stated that his invention was distinct from Kamil because Kamil used prepaid tickets which do not have inherent value, and thus, are not "products."

The Court concludes that Katz did not unambiguously state that his invention required products with inherent value apart from the participation number; it is possible, *625 for example, that Katz's distinction was based on the fact that Kamil's special code connected with the prepayment for telephone calls did not specify a limit on use. Katz did not mention Kamil's use of a prepaid ticket as a method of recording the prepayment in his statements so it is not clear that Katz was using the concept of a prepaid ticket as the basis for his distinction. In addition, these statements were made by Katz in a voluntary amendment, not in an effort to change the examiner's decision on a rejected claim. Thus, the Court concludes that Katz's statements do not indicate a clear disavowal of coverage so as to require that "products" have inherent value apart from the participation numbers. *See York Products*, 99 F.3d at 1575.

Based on the foregoing, the Court concludes that "products carrying participation numbers" means: a physical item sold or exchanged in a commercial setting which carries a number allowing participation in the Katz system.

2. "Accounting data"

[42] The second term from the Claims Involving Products Carrying Participation Numbers that the parties have presented to the Court for construction is "accounting data." This term appears in Claim 44 of the '707 patent, which includes the step of "providing on-going accounting data to said individual callers at intervals during calls from said individual callers."

The plaintiffs argue that "accounting data" should be construed according to its ordinary, common meaning, which is information relating to a reckoning or a computation. (Pls.' App. 83-84). The defendants argue that "accounting data" means callers' scores in the television game show format because that is the only format in the specifications in which Katz discusses accounting data.

The claim language does not support the construction proposed by the defendants. Nothing in Claim 44 indicates that "accounting data" should be limited to only callers' scores in a television game show format. In addition, Claim 45 of the '707, which is dependant on claim 44, provides for the step of "accounting for said limits on use for said participation numbers for said individual callers by incrementing or decrementing on-line said cumulative use for said individual callers to said limits on use." In this claim, the concept of accounting connotes keeping a record of the usage of the Katz system according to set limits on use associated with a caller's participation number; the language of this claim in no way limits the concept of accounting to scores in a game show.

The defendants contend that Column 16, lines 44-53 of the '707 patent is the only place that Katz describes "accounting data." In that passage of the specification, Katz discusses a television game show format and states that:

> The participant data is stored in an assigned cell of the memory 98 (FIG.4) for the caller and as the game proceeds, the processing unit 92 tallies the caller's score. Scores are interrelated between individual processing units to actuate the terminal CT. Thus, individual accounting occurs for each of the calling participants on an on-line basis dependant upon the success of the studio players and their association with the callers. On-going accounting data may be provided at intervals or real time by the recorded voice to each contestant.

However, in Column 17, lines 44 through 48 of the '707 patent, the specifications reads "the table 99 may be a large, shared unit that tabulates each of the key numbers and accounts for their use. If the caller has identified a proper key number, the process proceeds and the key number is accounted, i.e. incremented or

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works

decremented to the limit of use if any." Contrary to the defendants assertion, Katz discusses accounting in this passage of the specification in a context other than a television game show format. This passage of the specification is consistent with the language ***626** of Claim 45, which adds the step of "accounting for said limits on use for said participation numbers," and indicates that "accounting data" may relate to the limits on use specified in the participation numbers or consumable key numbers, and not only callers' scores in a game show. Further, even if the only example of "accounting data" in the specification were in the television game show context, the Court finds no reason in the claim language to restrict the term to a disclosed embodiment in the specification. *See Johnson Worldwide*, 175 F.3d 985, 989.

The defendants argue that the prosecution history of the '707 patent supports their construction of "accounting data." In a Supplemental Amendment dated December 28, 1994 during the prosecution of the '707 patent, Katz added Claim 53, which eventually became Claim 37 (upon which Claim 44 depends). In his remarks, Katz stated that "[s]upport for the 'accounting' distinction may be found, for example, at page 34, lines 11-21 of the present specification," which corresponds to the passage in the specifications upon which the defendants rely. The Court concludes that this statement by Katz in no way limits the term "accounting data" to only callers' scores during a television game show format, as evidenced by his use of the phrase "for example."

The claim language and the specification makes it clear that a caller's score in a television game show format is accounting data, but it only one example of accounting data, not the term's definition. Based on the foregoing, the Court construes the term "accounting data" in accordance with its ordinary, common meaning to mean: information relating to a computation of data.

3. "Operations of the Interface"

[43] The third term from the Claims Involving Products Carrying Participation Numbers the parties have presented to the Court for construction is "operations of the interface." This term appears in the preamble of Claims 44 and 93 of the '707 patent and Claims 79 and 190 of the '863. The language containing this term varies slightly in the claims, but generally provides for "[a] process for controlling operations of an interface with a telephonic communication system." The term "operations of the interface" as it appears in the preamble is also referred to in the limitations of the claims, such as "to access said operations of the interface."

The defendants argue that "operations of the interface" is synonymous with "format." The plaintiffs contend that the term should be construed as "the set of processes or actions that effectuates interactive connection and that is part of the work performed by the system connected to the telephone network." (Pls.' App. at 68).

The claim language does not support the defendants' limited construction of this term. In the second limitation of Claim 37, upon which Claim 44 depends, the claim includes the step of "receiving said call data signals ... to select a specific operating format from a plurality of operating formats of said operations of the interface." This claim recites both the terms "format" and "operations of the interface." The use of both terms separately in the same claim indicates that they have different meanings. In addition, the claim refers to selecting one of a plurality of operating formats of the operations of the interface, which shows that the operations of the interface includes more than one format. Further, the term "format" is not present in Claims 93 of the '707 patent or Claim 190 of the '863 patent, which indicates that the operations of the interface do not necessarily include a format.

The term "operations of an interface" is not discussed in the specification. The defendants point out that in Column 10, lines 32, 39, and 43, Katz refers interchangeably to "mail order operating format" and "mail order interface." From this portion of the specification, however, the Court cannot conclude that the operations ***627** of the interface can *only* include a format.

The Court concludes that there is no reason in the claim language or specifications to depart from the ordinary, common meaning of "operations of the interface." Based on the foregoing and consistent with the Court's construction of "interface structure," the Court concludes that the term "operations of an interface" means: the processes, activities, or functions of the interactive connection between the processors upon which the Katz system is running, the communication facility, and the callers. The term does not require that the Katz system be running a format, or specifically, one of the seven formats disclosed in the specifications.

4. "Answer Data"

[44] "Answer data" is the fourth term the parties have presented to the Court for construction from the

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works

Claims Involving Products Carrying Participation Numbers. The term appears in Claims 44 and 96 of the '707 patent and Claims 79 and 190 of the '863 patent. The language of the limitations in which "answer data" appears is almost identical in each patent and reads "receiving digital identification data from said individual callers responsive to said voice signals including said participation numbers for said individual callers and answer data developed by said remote terminals under control of said individual callers."

The parties agree that the clear meaning of "answer data" is responses by callers to vocal questions or prompts. The defendants ask this Court to exclude any response that includes a telephone number, and specifically the telephone number of the party the caller would like to reach, from the definition of "answer data."

The defendants argue that the specifications describe callers providing answers to questions only in the context of one of the Katz formats, and because making a telephone call is not a format, a telephone number cannot be included in the definition of "answer data." *See* Column 7, lines 46 and 59; Column 17, line 8; Column 19, line 17 of the '707 patent. Even taking the defendants characterization of these passages of the specification as true, the Court has already rejected the defendants' narrow definition of the term "format" in the context of these patents. Further, there is nothing in the passages of the specifications cited by the defendants that indicates that answer data could not include any telephone number, including the number the caller is trying to reach.

The Court concludes that there is nothing in the claim language or specification that restricts the ordinary, common meaning of the term "answer data," which denotes data containing answers or responses. The defendants argue that "answer data" cannot encompass all answers to questions because the claims refer to some types of answers with specific terms, such as participation numbers. Although the claims recite different terms to refer to some specific responses received from the callers, the use of these more specific terms does not indicate that the broad term "answer data" cannot encompass these responses as well.

The prosecution history cited by the defendants does not support their construction of "answer data" nor does it limit the ordinary, plain meaning of the term as expressed in the claims. The defendants argue that Katz distinguished his inventions from a patent to Newkirk, which involved a system that enabled callers to make calls at pay telephones using a magnetic stripe on a card. In the prosecution history of the '968 patent in a Supplemental Amendment dated May 4, 1988, Katz stated that:

> The Newkirk et al. patent (4,439,636) is directed to a system for enabling a magnetic stripe card to be used at a pay telephone somewhat independently of the composite telephone system. Although the Newkirk patent discloses digital communication between a remote ***628** terminal and central terminal, the communication essentially involves the magstripe of a credit card. Distinct from applicant's development, Newkirk does not contemplate any operations related to statistical analysis. Specifically, with respect to the claims herein, while the Newkirk patent utilizes a calendar clock and form records for purposes of billing, the system does not store any form of "answer data."

(Ex. 33). The defendants contend that Katz's statements indicate that a telephone number could not be answer data. The Court concludes that Katz's statement that the Newkirk system did not store any form of answer data does not limit the term "answer data" to exclude responses that include telephone numbers. Katz stated that the only communication between a remote terminal and a central terminal was through the magnetic stripe; such a magnetic stripe would not have constituted "answer data" as this Court concludes that term is used in the Katz patents.

Although not addressed by Katz in his statements regarding Newkirk, the defendants argue that the Newkirk patent provided for callers to be "prompted" by a dial tone to enter the telephone number they were trying to reach. Thus, the defendants argue, Newkirk involved callers' responses to prompts and Katz statement that Newkirk did not include answer data indicates that Katz was disclaiming responses involving telephone numbers from the scope of the term. The Court is not persuaded by this argument for two reasons. First, Katz did not mention that Newkirk prompted callers with a dial tone in his discussion of the Newkirk patent; thus, the Court will not limit Katz's claims by a statement that he did *not* make during the prosecution of the patents. Second, the patents make clear that the questions or prompt must be vocal or voice generated. [FN26] Thus, the dial tone used in Newkirk is not a "prompt" or "cue" as used in the Katz patents.

FN26. Claim 44 provides support for the notion that the questions or prompts are vocal in nature. The third limitation in Claim 37, upon which Claim 44 depends,

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works

> provides for "coupling said remote terminals to said interface for providing voice signals to said individual callers and generating said voice signals for actuating said remote terminals as to provide vocal operating instructions to specific ones of said individual callers." The specification also supports the idea that answer data is responses to vocal questions or prompts. *See* Column 7, lines 46 through 53 of the '707 patent.

During the prosecution of the '846 application, Katz distinguished his patent from a patent to DeBruyn. (Ex. 66). In an Amendment dated July 7,1997, Katz stated:

> DeBruyn is silent as to the fourth and fifth steps of claim 31. These steps provide: "cueing callers with selected questions from a batch of questions;" and "receiving answer data ... responsive to the selected questions." DeBruyn prompts callers for simple and fixed input: a phone number and a Lotto number, which can be confirmed and corrected in linear fashion. There is no suggestion or disclosure of selected "questions from a batch of questions." DeBruyn does not contemplate a selection of the same or different questions for different callers, from a batch of questions. DeBruyn, by its silence, can not imply cueing callers with those questions, nor receiving answer data in response to those questions.

It is clear that in these statements, Katz was distinguishing his patent from DeBruyn on the basis that DeBruyn did not select questions from a batch of questions or receive answers to those questions from a batch of questions. These statements clearly do not indicate that answer data cannot include any telephone number, including the number the caller is trying to reach.

Based on the foregoing, the Court concludes the term "answer data" to mean: responses from callers to vocal questions or prompts.

*629 C. CONDITIONAL FORMAT CLAIMS

The Conditional Format Claims include Claim 15 of the '150 patent and Claims 17, 20, 24, and 77 of the '285 patent. In general, the '150 and '285 patents describe a system and a method for interfacing callers with a processing system which can handle multiple callers and run multiple formats. The '285 patent also includes the option of interfacing callers with a live operator who receives prompts from the processing system. Certain of the formats of the processing system may contain conditions which restrict access to their use by callers; these conditions are stored in memory in the processing system in connection with the corresponding format. Call data, including the called number, the calling number, and the equipment signals, is used by the processing system to select the format the caller wishes to access and to restrict access to formats according to any associated conditions.

Claim 15 of the '150 patent and Claim 17, 20, and 24 of the '285 patent are method claims; Claim 77 of the '285 patent is an apparatus claim. The method claims are very similar and all contain at least four basic steps, including receiving call data signals, selecting a format under control of the call data signals, testing the selected format in relation to the call data signals, and conditionally interfacing said selected format with the calling terminal. The text of these claims is set forth in the Appendix.

The parties' arguments regarding the proper construction of the testing step and the sequence in which the four basic steps in the method claims must be performed are intertwined. The plaintiffs argue that the "testing the selected format step" includes the test referred to in the specification as the "validity bit check," which tests the ANI of the caller against a negative list of "bad" ANIs stored in memory. Under this construction, because the validity bit check may be performed before the selecting step, the testing step could be performed before the format is chosen in the selecting step. The defendants argue that the validity bit check is not encompassed by the testing step, but rather is separately called out in Claim 24 of the '285 patent; thus, as is clear from the claim language, the steps must be performed in the sequence in which they are listed in the claims. The proper construction of the testing step will be addressed first.

1. "Testing the Selected Format"

[45] The first term the parties presented to the Court for construction from the Conditional Format Claims is "testing the selected format." This term appears in all four of the method claims, and reads in context "testing the selected format in relation to said call data signals." Although the claim language is unclear as to whether the test is performed *on* the format or *for* the format, the parties agree that "testing the selected format" means the step of performing a test based on conditions associated with a format before a caller is allowed to interact with a format.

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works

The disagreement surrounds the scope of the testing step. In addition to the argument over whether the validity bit check is encompassed by the testing step, the parties disagree over whether the test must include the use of a control word or control data and whether the test that is performed must be specific to each format or if formats may be conditioned as a group. The defendants contend that the step of "testing" must involve the use of, or "fetching" of, a "control word" to identify the conditions associated with the selected format. The plaintiffs contend that the step of testing does not necessarily include fetching a control word associated with the selected format and that Katz disclosed other types of testing in the specifications that perform this step of the claims. The plaintiffs contend that a test may apply to groups or categories of formats, or to all of the formats. The defendants contend that the testing step cannot ***630** perform the function of excluding a caller from accessing any formats at all but rather, the testing step determines whether conditions specific to the selected format are satisfied.

The claim language of the testing step is helpful, but not conclusive. The language of the claims does not clearly indicate what the step of testing the selected format involves. The Conditional Format Claims recite "testing *the selected* format," which indicates that the test is performed on one particular format that has in some way been selected. The claim language does not indicate whether or not the same test could be given to a group of formats or if all formats could be tested for a single caller at the same time. Claims 11, 12 and 13 of the '150 patent, which like Claim 15 depend on Claim 10, add the steps of "fetching control data addressable with said call data for use in the step of testing," "composing a control word defining conditions for interfacing," and "fetching data to specify time constraint conditions." These claims specifically call out the steps of composing a control word and fetching control data, which suggests, consistent with the concept of claim differentiation, that the concept of control data is not necessarily implicit in the testing step of independent Claim 10. The claim language does not preclude the possibility that testing other than based on a control word could be encompassed in the testing step. Thus, the analysis must proceed to the respective specifications.

The specifications of the patents describe three main types of testing that are performed on calls. The first type of testing is performed using a control word or control data, which is available for each format and imposes any conditions on accessing the format. *See* Column 5, lines 21 though 25 of the '150 patent. Column 6 lines 54 through 57 of the '285 patent provides that "a control word is available for each operating format of the processor P and is utilized to impose the conditions for an interface and the terms of any associated billing." Similarly, in Column 9, lines 3 through 7, the specification provides "each of the operating formats has a control word for defining any access conditions or limitations to accomplish a specific format." Katz explains that the control words are bits in the control register which indicate the presence and content of conditions associated with a format. *See* Column 9, lines 27 through 37 of the '285 patent. For example, Katz describes test conditions based on the time of the call, the calling history of the caller, and the demographics of the caller. *See* Column 9, line 37 through Column 10, line 9 of the '285 patent.

The specification also discusses testing or conditioning calls as a group. For example, the specification provides "the [historical] record might take the form of either a negative or a positive file (for an individual format). In that regard, formats involving 'pay to dial' calls might be conditioned as a group." Column 5, line 64 through Column 6, line 2 of the '150 patent. Katz also describes "decimal equivalent coding" as a way to condition formats as a group. Katz states that all formats of a particular type may be assigned in a "decimal series," such that all lotteries would be assigned a number in a "100" series, e.g., 101, 102, 103, etc. For example, a caller's ANI may be associated with a decimal series which would exclude that caller from participation in any formats in that decimal series. *See* Column 10, lines 27 through 30 of the '285 patent. The specification provides that decimal equivalent coding "enable[s] a substantial number of formats to be designated and coded with respect to various classifications." Column 8, lines 5 through 17 of the '150 patent; Column 10, lines 10 through 30 of the '285 patent.

Katz also discussed what he refers to as the validity bit check. The validity bit check compares the ANI, or calling number, of the caller to a list of ANIs that are stored in memory. If it is a negative list and the caller's ANI appears on the list, ***631** the caller will be denied access to the Katz system regardless of the format. If it is a positive list, the caller's ANI must appear on the stored list in order to access the Katz system regardless of the format. *See* Column 4, line 60 through Column 5, line 5 of the '150 patent. It is also possible that the calling equipment may appear on a stored list which determines a caller's access to any of the formats. *See* Column 5, lines 1 through 14 of '150 patent.

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works

It appears both side agree that Claim 24 of the '285 patent corresponds to the validity bit check described in the specification. The claim provides for "storing a record of negative file data, said select processing format using said additional call data signals to access said record and obtain data to specify and test for negative file conditions." The defendants say that Claim 24 does not alter the testing step of the independent claim; rather, the defendants argue it is an additional step that occurs before the testing step.

The Court concludes that, based on the claim language and the specifications, the testing step does not encompass testing formats as a group, such as through the decimal equivalent coding or the validity bit check disclosed in the specifications. The clear language of the claim recites testing "*the selected* " format. According to the specification, decimal equivalent coding is performed on a group of formats at one time and does not operate on the format that is selected by the call data signals. Thus, the Court invokes the legal rule that the specification may not expand the clear meaning of the claim language. As well, the specification shows that the validity bit check is based on the ANI or equipment signal of the caller and is not associated with any conditions placed on a selected format. Based on the foregoing, the Court concludes that "testing the selected format" means: the method by which it is determined whether any conditions associated with the format that has been selected by the call data signals are satisfied.

2. The Sequence of Steps in the Method Claims

The parties disagree over the sequence in which the four basic steps in the method claims, i.e., receiving call data signals, selecting a format, testing the selected format, and conditionally interfacing, must be performed. Specifically, the disagreement centers around the sequence of the selecting and testing steps. The defendants contend that there is a presumption that the steps in a method claim must be performed in the order they are listed in the claim particularly where, as here, the claim language indicates that the testing step must follow the selecting step. The plaintiffs contend that in some embodiments of the invention the testing step could be performed before the selecting step, particularly a situation where a group of formats are being tested, such as the validity bit check.

[46][47] Where the plain meaning of the claim language indicates a sequential nature to the claim steps and the specification does not suggest otherwise, the steps must be performed in the order written in the claim. *See Mantech Environmental Corporation v. Hudson Environmental Services, Inc.*, 152 F.3d 1368, 1376 (Fed.Cir.1998). The testing step provides for "testing *the selected* format," which suggests that the format must be selected before this step can occur. While the specification does indicate that the validity bit check and other testing of formats as a group may occur before the selection of the format, the Court has already concluded that the validity bit check and other group testing is not encompassed by the testing step. Given the clear language and the suggested sequence of the steps provided in the claims, the Court concludes that: the testing step must be performed after the selecting step.

There is also some disagreement over the sequence in which the additional steps other than the four basic steps should be performed in the method claims. Claim 11 ***632** calls out the additional step of "fetching control data addressable with said call data for use in the step of testing." Claims 15 calls out the additional step of "fetching data to specify demographic conditions." Thus, the Court concludes that it is clear from this claim language and the passages of the specifications discussed above regarding control words that: the steps of fetching in Claim 11 and Claim 15 must occur before the testing step.

Claim 20 of the '285 patent contains the additional steps of "selectively terminating certain select calls from said remote terminals in favor of said operator attended terminals" [FN27] and "transferring substantially all of said certain select calls from said operator attended terminals back to said multiple port, multiple format data processing system." The defendants argue that these steps must be performed after the four basic steps that appear before them in the claim.

> FN27. Claim 24 of the '285 also contains the step of selectively terminating certain select calls.

Claim 24 of the '285 patent includes the steps, in addition to the four basic steps, of "providing signal-represented call data from said remote terminals including calling numbers as additional call data signals" "storing a record of negative file data, said select processing format using said additional call data signals to access said record and obtain data to specify and test for negative file conditions," and

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works

"terminating calls from said remote terminals if said calling number matches said data obtained from said negative file data." The defendants argue that the selectively terminating step must be performed after the four basic steps and the providing step, the storing step, and the terminating step must be performed before the four basic steps are performed.

As for the additional steps in Claims 20 and 24 of the '285 patent, the defendants do not point to any passages of the specification that demonstrate that the additional steps in those claims must be performed in any particular order. There is nothing in the claim language that suggests that those steps must be performed before, after, or during the four basic steps called out in the claims. Interpreting the plain claim language, there is no reason why calls could not be transferred to a live operator or transferred back to the system at any time during a call. Similarly, there is no reason shown in the claim language why a call could not be terminated at any time if the calling number matched negative file data. Thus, the Court concludes that: the claims do not require that the additional steps of Claims 20 and 24 be performed in any particular order.

3. "Call Data Signals"

[48] The term "call data signals" which appears in the "testing the selected format" limitations also raises construction issues for the Court. In Claim 15 of the '150 patent and Claim 17 of the '285 patent, the term "call data signals" appears in the preamble and reads "call data signals, as to indicate called and calling numbers." In Claims 20 and 24 of the '285, the term "call data signals" is not limited in the preamble or elsewhere in the claim to called and calling numbers. The parties agree that in those claims, "call data signals" refers to called numbers, calling numbers, and equipment signals. *See* Column 4, lines 53 through 58 and 65 through 68 of the '285 patent.

The parties dispute the meaning of the term "equipment signals." Specifically, the defendants contend that "equipment signals" is limited to the signal disclosed in the specification, which is a signal that indicates whether the caller is using a touch tone telephone or a rotary dial telephone. Column 3 lines 65 through 68 of the '150 provides that "the call data may specifically include digital signals representative of the called number, the calling number (terminal number) and the terminal equipment." Column 4, lines 10 through 28 of the '150 patent provides that call data may be provided by the communication *633 facility for the called number, the calling number, and "equipment, e.g. [*exempli gratia*] 'pulse' or 'tone' terminal." These passages of the specification do not require that the equipment signal only indicate whether the caller is calling from a pulse or tone terminal.

Column 11, lines 28 through 36 of the '285 patent provides that "[t]he bits '29' and '30' comprise a field 83 and may actuate a special form of the selected format. In the disclosed embodiment, the field 83 registers call data, as to indicate that the calling terminal is a 'pulse' (rotary dial) signal unit or a 'tone' (touch) signal unit." Field 83 in Figure 5 is labeled "equip." The plaintiffs argue that by dedicating two bits in memory for the equipment signal, Katz indicated that equipment signals may encompass more than touch tone or rotary, because only one bit would have been required to store that information. In light of the specification and Figure 5, the Court concludes that "equipment signal" is not limited to a signal indicating whether the caller is using a touch tone or rotary phone and means: a signal that provides information about the equipment from which the caller is making a call.

Another dispute the parties raised in connection with the term "call data signals" is which call data signals may be the basis for a test in the testing step. The defendants argue that the only call data signal that can be tested in the testing step is DNIS. The defendants argue that the equipment signal cannot be tested because equipment signals for touch tone or rotary phones did not exist at the time of the Katz patents. Putting aside whether an equipment signal that indicated rotary or touch tone phones existed at the time of the Katz patents, the specification clearly indicates that the equipment signal may be the basis for disqualifying callers from interfacing with a format. *See* Column 5, lines 1 through 4 of the '150 patent. The claims language of the testing step is "testing the selected format in relation to said call data signals." Although Claim 15 of the '150 patent and Claim 17 of the '285 patent do not include equipment signals from the scope of call data signals in the preamble, there is no basis in the claim language or the specifications to conclude that the call data signals in the testing steps in Claim 20 and 24 of the '285 cannot include the equipment signal.

The defendants also argue that ANI cannot be included in the call data signals of the testing step because Katz disclaimed coverage for testing ANI in the prosecution history. The specifications clearly indicate that a caller's ANI may be used to disqualify him from interfacing with a format. *See* Column 4, lines 61 through 68 of the '150 patent. In the June

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works

23, 1993 Supplemental Preliminary Amendment during the prosecution of the '285 patent, Katz distinguished his invention from a patent to Fisher by stating that "the patent to Fisher does not disclose receiving calls from random or unknown callers at large and limiting access upon testing *imposed conditions specified by call data including DNIS* from unknown callers." (Ex. 50) (emphasis in original). Contrary to the defendants' assertions, the Court concludes that Katz's statement, "call data including DNIS," is not exclusionary or limiting language and does not exclude ANI from the term "call data signals" in the testing step. Thus, the Court concludes that: the call data signals in the testing step may include the calling number or ANI.

4. "Conditionally Interfacing"

[49] The parties also dispute the meaning of the term "conditionally interfacing the selected format." The parties agree that if the testing step is satisfied, that is, the test is performed and the conditions are fulfilled, then the caller is connected to the selected format. The defendants contend that if the conditions associated with the format are not satisfied in the testing step, the caller is not connected to the format. The plaintiffs contend that the ***634** claims are silent as to what happens if the tested conditions are not satisfied.

The term "conditional interfacing" in the context of the Katz patents connotes that the caller will be connected or interfaced with the selected format if any conditions associated with that format are satisfied. The term in itself does not connote what happens to the call if the format conditions are not satisfied, other than the call will not be interfaced with the format.

The specification provides that after the tests have been performed, "[i]f the call is accepted, the process moves to initiate the selected format interface as indicated by the block 40. Conversely, if the call is to be rejected, the process moves to the step indicated by block 32, i.e. reject the call as with a message and release the line." Column 6, lines 34 through 41 of the '150 patent; Column 8, lines 4 through 6 of the '285 patent (identical provision). Figure 2 of the '285 and '150 patents, which are flow diagrams illustrating the operating process of the system, indicate that if the tests are not correlated, i.e. the conditions are not met ("No" at 48), the call flows in the direction of the arrow to 32, and the caller receives a reject message (32) and the line is released (34).

The specifications indicate that one possible result from a call in which the conditions associated with the selected format are not satisfied is that the call will be rejected and the line released. However, there is nothing in the specifications or the claim language that requires a call to follow the disclosed embodiment in Figure 2 and the specifications reciting the embodied result of rejecting the call and releasing the line. Further, the term "conditionally interfacing" does not in itself raise the question as to what happens to the call if the conditions are not satisfied other than that the call it not interfaced with a format, and there is no other language in the claims that otherwise restricts what happens to a call if the conditions of a format are not satisfied. The Court will not import the limitation on the claim language proposed by the defendants from the specification because there is no "hook" in the claim language on which such a limitation can hang. *See Renishaw PLC v. Marposs Societa' per Azioni*, 158 F.3d 1243, 1248, 1252 (Fed.Cir.1998). Thus, the Court concludes that the claims does not require that the call be terminated if the conditions are not satisfied and the call is not interfaced.

Based on the foregoing, the Court construes the term "conditionally interfacing" to mean: connecting a call to the selected format once any conditions associated with that format have been satisfied.

5. "Live Operator Attended Terminals"

[50] The dispute surrounding the term "live operator attended terminals" centers on whether the prompts provided to the live operators must be identical to the vocal prompts in the automated formats. The plaintiffs contend that the prompts need only assist the operator with the call; the defendants contend that the prompts must simulate the automated format completely.

The claim language does not restrict the prompts displayed to live operator attended terminals in any way. The language of most of the claims at issue from the '285 patent calls out "a plurality of live operated attended terminals." Claim 17 of the '285 patent merely refers to "one of a plurality of operator stations with prompting capability."

As well, the specification does not indicate that the prompts to the live operator must mimic the automated formats. In Column 3, lines 20 through 24 of the '285 patent, the specification indicates that the processor provides formats to automate an interface or prompt a live operator at an operator station. In Column 5, lines 25 through 27 of the '285

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works

patent, the specification provides that the operator station upon receiving a call receives and displays prompting format data for the attending ***635** operator. Similarly, Column 6, lines 10 through 14 of the '285 patent indicates that when a caller is coupled to an operator station, the appropriate format data is transferred to the station for prompting the operator.

The Court concludes that: there is no indication in the claim language or the specification that the prompts displayed at the operating stations must be identical to the vocal prompts used in the automated formats. Thus, the Court concludes that: the Claims at issue are not restricted in that way.

6. "Selecting a Processing Format"

[51] The dispute surrounding this limitation is over which data signals control the selection of the format. As discussed above, in Claim 15 of the '150 patent and Claim 17 of the '285 patent, the limitation which reads "selecting a processing format of said multiple port, multiple format processing system for the calling remote terminal under control of said data signals as the selected format" indicates that the format is selected by the called and calling number, because "said" data signals are listed in the preamble of the claim as the called and calling number. However, in Claims 20 and 24 of the '285 patent, the data signals are not limited in the preamble of the claim; thus call data signals refers to the calling number, the called number, and the equipment signal.

The parties appear to agree that, despite the claim language "data signals," the only call data signal that selects the format is DNIS, or the called number. The specifications support this position. *See* Column 4 lines 30-31 of the '285 patent ("[T]he call unit CU might be reached by any of twenty telephone dialing numbers, each associated with a specific operating format of the processor P. One called number or set of numbers might be associated with an auction format of the processor P."); Column 5, lines 18 through 24 of the '150 patent ("If a positive validity bit ('1') is formed at the junction of the query block 30, a control word is fetched under command of the called number as indicated by the block 36."); Column 7, lines 13 through 19 of the '150 patent ("The control register 70 receives format control words specified by the called number and having a form as illustrated in Fig. 4."). The Court agrees that despite the use of the broad term "call data signals" in the claim language, it is clear in the context of the patent as a whole that the only call signal that could be used to select a format is the called number or DNIS.

7. "Demographic Conditions"

[52] Claim 15 of the '150 patent recites "[a] process according to claim 11 wherein said step of fetching control data includes fetching data to specify demographic conditions." The parties disagree over the construction of the term "demographic conditions." The plaintiffs argue that "demographic conditions" refers to conditions based on the geographic location of the caller. The defendants contend that "demographic conditions" pertain only to the area code of the caller.

It is clear from the specification that the term "demographic conditions" does not have its ordinary and common meaning in the context of the Katz patents, as both parties agree. In the context of discussing various tests or conditions that may be imposed, the specification provides that "[m]oving from the historic considerations, demographic tests may be specified as in relation to the geographic area manifest by the area code of the calling number." Column 6, lines 24 through 27 of the '150 patent. *See also* Column 12, lines 19 through 25 of the '150 patent. Katz lists several examples of "demographic conditions" in Column 7, lines 61 through 68 of the '150 patent. While all of the examples are conditions limiting calls based on a particular area code, one of the examples is a condition that limits calls to ANIs from a particular area code with particular prefix numerals.

***636** The Court concludes that although the specification discusses demographic conditions in terms the area codes of the calling numbers, there is nothing in the specification that indicates that an area code can be the *only* basis for a demographic condition. Indeed, in one of the examples provided in the specification by Katz, the callers' area codes are used in conjunction with the prefix numerals of the calling numbers to indicate the callers' geographic area and limit the calls from a particular area. This convinces the Court that "demographic conditions" are not restricted to conditions based on the callers' area codes only. Thus, the Court construes the term "demographic conditions" to mean: conditions used to limit a call based on the caller's geographic area.

8. "Means for Directly Forwarding"

[53] Claim 77 of the '285 is an apparatus claim and contains a limitation which reads "means for directly forwarding a call coupled to said interface means for forwarding a call from any one of said remote terminals to one of said plurality of live operator

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works

attended terminals under control of said call data signals when said remote terminals do not have the capability to digitally provide data."

The parties agree that this limitation is subject to means plus function analysis under § 112, ¶ 6. The function performed by the "means" is directly forwarding a call from a remote terminal to a live operator attended terminal. The defendants argue that although there is no structure that is clearly linked in the specifications to the function disclosed in the claims, this Court should identify the switch SW, line capture unit 62, call register 68, and the control unit 66 from Figures 1 and 3 of the '285 patent as the structures that correspond to the means.

Figure 3 illustrates elements of the switch SW in Figure 1. *See* Column 8, lines 32 through 34 of the '285 patent. Column 8, lines 50 through 57 of the '285 patent describes some of the elements of Figure 3 and provides that "[t]he line capture unit 62 also is connected to a control unit 66. Structurally, the control unit 66 may take the form of various computer facilities incorporating memory and logic capability to sequence and control specific functions.... Generally the control unit 66 implements specific formats which may involve coupling a caller either to a live operator station OS1--OSn or to the processor P." Column 12, lines 55 through 59 of the ' 285 patent indicates that "[i]f the call register 68 does not receive a validity '1' bit, the calling number is indicated to be barred with a consequence that the line is released by the control unit 66."

The Court concludes that based on the specifications, the structure that corresponds to the means is generally the switch SW in Figure 1 and specifically the control unit 66 in Figure 3. Based on the their descriptions in the specifications, the Court concludes that the other structures identified by the defendants, the line capture unit 62 and the call register 68, do not perform the function of directly forwarding a call from a remote terminal to a live operator attended terminal recited in the claim.

The defendants argue that because the claim also requires that the forwarding occur "when said remote terminals do not have the capability to digitally provide data," it does not apply in a situation in which a caller with a touch tone telephone fails or chooses not to push a button on the telephone. The Court concludes that in light of the ordinary and common meaning of the term "capability," this claim means that: a caller is switched to a live operator only when the remote terminal from which the caller is calling is not technically capable of digitally providing data.

D. CLAIMS FROM THE '984 PATENT

The parties have presented Claims 4 and 15 of the '984 patent to the Court for *637 construction. The text of these claims appears in full in the Appendix.

In general, the '984 patent describes a system for use with a telephone network that controls callers' access to interactive voice applications to prevent misuse. The system can restrict callers' access to interactive voice applications by qualifying calls in different modes, such as "800" mode, "900" mode, or area code mode.

1. Claim 4

a. "First Response Unit Means"

[54] The first term presented by the parties to the Court for construction from the '984 patent is "first response unit means." The term in context reads "first response unit means for receiving calls in said '800' call mode." The plaintiffs argue that this term is not subject to means-plus-function analysis, despite the use of the word "means."

The Court concludes that "first response unit means" is not subject to means plus function analysis, despite the presumption to the contrary due to the word "means." The article presented by the plaintiffs, entitled "AT & T 2: Reaches Agreement with Rockwell" and dated August 26, 1986, discusses the use of audio response units in merging computer speech technology with automatic call distribution systems. (Ex. 362). The Court concludes that this article demonstrates that the term "audio response unit" or "ARU" was used by people in the art of computer telephony and would have connoted sufficient structure to those of ordinary skill in the art at the time. *See Greenberg v. Ethicon Endo-Surgery, Inc.*, 91 F.3d 1580, 1583 (Fed.Cir.1996).

The parties also dispute the meaning of the term "800 call mode" which appears in the same limitation. The plaintiffs contend that this term encompasses "800," "888," and other "toll-free" calls. The defendants agree with this construction, but argue that the term encompasses any call in which the charges are reversed and the call is free to the caller, including foreign access calls and "collect" calls.

Column 1, line 66 through Column 2, line 2 of the '984 patent provides that "[t]elephone calls may be

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works

accommodated without charge using '800' service or calling mode. Generally, the '800' calling mode accommodates free calls by callers in various areas to a particular station incurring the charges." The Court concludes that it is not proper to determine at the construction stage whether "foreign access calls" and the like are specifically encompassed in the term "800 call mode." The Court agrees with the parties that the proper construction of "800 call mode" is: a toll-free call, ie. a call in which the caller is not charged for the call, such as an "800" or "888" call and the like.

b. "Qualification Means"

[55] The term "qualification means" appears in context as "qualification means for qualifying said calls in said '800' call mode received by said first response unit to provide qualified calls." The parties agree that this term is subject to means-plus-function analysis under § 112, ¶ 6.

Column 4 lines 9 through 14 of the '984 patent provide that "with overall supervision by the control unit 28, the audio response units, 18, 20, and 22 answer and preliminarily qualify callers from the terminals T1-TN for connection through the coupler 24 to the interface processor 26." Column 4, lines 47 through 50 provide that " '[t]he audio response unit 18 is coupled to a free-call memory 32.' Generally, the unit 18 in cooperation with the memory 32 operates with the control unit 28 to qualify acceptable calls in the '800' mode."

The Court concludes that "qualification means" is subject to means-plus- function analysis. The Court concludes that the structures which correspond to the means and perform the function of qualifying said calls in '800' call mode are the audio response unit 18, control unit 28, and the free-call memory 32 in Figure 1 and the ***638** required software to perform the function of qualifying callers.

c. "Second Response Unit Means for Receiving Calls in a Second Call Mode"

[56] The third limitation in Claim 1 of the '984 patent, upon which Claim 4 depends, provides for a "second response unit means for receiving calls in a second call mode." The parties dispute the meaning of the term "second call mode." The plaintiffs contend that the second call mode could encompass anything other than the 800 call mode, which is called out in the first limitation of the claim. The defendants contend that the second call mode must encompass a 900 call mode because a 900 call mode is called out in the preamble to the claim.

The preamble of Claim 4, which appears Claim 1, reads in part "[a] telephone call processing system for receiving calls from a multitude of terminals in different call modes including an '800' call mode and a '900' call mode." The central dispute is whether the recitation of " '900' call mode" in the preamble is a limitation on the claim such that the second call mode called out in the third limitation must be a 900 call mode.

[57] In determining whether the preamble is an additional limitation to the claim, a court must divine the function that the words of the preamble serve. If the claim preamble recites structural limitations of the invention, a court should consider the preamble a limitation on the claim. *See Rowe v. Dror,* 112 F.3d 473, 478 (Fed.Cir.1997). If the claim preamble recites a purpose or intended use for the invention in the preamble and the claim body recites a structurally complete invention, the preamble is not a claim limitation. *Id.* The patent as a whole should be reviewed to determine whether the preamble is structural or a mere statement of the purpose or use of the invention. *Id.*

The preamble of Claim 1 of the '984' patent calls out a system "for receiving calls from a multitude of terminals in different call modes including an '800' call mode and a '900' call mode." This quoted language does not invoke or refer to any structure of the invention. Similarly, the second response unit limitation recites that the second response unit receives calls in a second call mode. This language describes no structure as well. Thus, the Court concludes that the plain language of the Claim 1 indicates that the term "900 call mode" describes a function of managing the calls or a use of the invention, rather than a structural component of the system.

The specification is consistent with the claim language. Column 1, lines 54 through 66 of the '984 patent provides that

> [t]he '900' calling mode is useful for implementing games and contest with telephone interface systems; however, certain problems are encountered. Specifically, certain telephone terminals, e.g. pay phones, do not accommodate '900' service. Also, with respect to certain forms of games and contests, it is important to offer members of the public an alternative 'free' method of participation. In general, the system of the present invention may be employed to implement '900' calling modes while accommodating 'free'

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works

participation with reasonable control.

This passage indicates that the invention may be used with a 900 call mode as a method of solving the problems discussed in the specification. Column 2, lines 3 through 17 discusses the problems with using traditional area code numbers with interface systems, including the possibility that an overwhelming number of people will respond. This passage indicates that another use of the invention is addressing problems with area code calls. Thus, the Court concludes that using a 900 call mode is only one of the uses of the invention.

Based on the claim language and the specification, the Court concludes that " '900' call mode" as used in the preamble of Claim 1 is more descriptive of an intended use of the invention than of its structure, ***639** and thus, should not be construed as an additional limitation on the claim. Therefore, the Court will not construe the term "second call mode" to require the use of a "900 call mode" on this basis.

The defendants also argue that the prosecution history of the '984 patent requires that the second call mode be defined as the 900 call mode. In an Office Action dated March 21, 1991, the examiner rejected certain of Katz's claims as unpatentable over Fodale, including Claim 1. (Ex. 32). In the June 20, 1991 Amendment, Katz amended Claim 1 to specifically call out an 800 call mode and a 900 call mode in the preamble, just as the language appears in the claim as it was issued. The defendants contend that Katz included a "900 call mode" in Claim 1 in the June 20, 1991 Amendment to traverse the examiner's rejection of that claim, and thus, the term "second call mode" in the claim should be limited to the 900 call mode called out in the preamble of the claim.

The Court's careful independent review of the prosecution history, including the basis for the examiner's initial rejection of Claim 1, the amendments made by Katz, and the discussion in the amendment by Katz of the rejection of his claim as unpatentable over Fodale, reveals that the prosecution history cited by the defendants does not support their argument that "second call mode" should be limited to "900 call mode." The defendants point to no affirmative statement by Katz in his amendment that the term "second call mode" was synonymous with 900 call mode nor does the Court find any such statement by Katz. The mere addition of the term "900 call mode" in the preamble does not indicate that Katz was necessarily limiting the term "second call mode" because there is no statement in the prosecution history relating those two terms to each other. Katz did not in his June 20, 1991 submission amend in any way the use of the term "second call mode" in Claim 1, which left that limitation without reference to the term "900 call mode."

Further, in the same June 20, 1991 Amendment, Katz amended Claim 2 to specifically call out a system wherein the second response unit receives calls in 900 call mode. It may be plausibly inferred that Katz added the phrase "900 call mode" in the preamble of Claim 1 to support his amended Claim 2, rather than to specifically overcome the examiner's objection based on Fodale. Thus, the prosecution history is at best ambiguous as to why Katz added the term "900 call mode" in the preamble of Claim 1. Because Katz did not clearly disclose his intention to do so, the Court will not limit the plain meaning of the claim language based on this ambiguous prosecution history.

Based on the foregoing, the Court concludes that "second call mode" means: a call mode, such as a 900 call mode or an area code mode, other than 800 call mode. The term does not necessarily mean the 900 call mode.

d. "Means for Processing Calls in an Interface Format"

[58] The parties agree that this limitation of Claim 4 of the '984 patent is subject to § 112, ¶ 6. The function performed by the means is processing calls in an interface format. The plaintiffs identify the interface processor 26 as the corresponding structure. The defendants contend that the structures that correspond to the means are the processor 26, random number generator 40, question memory 38, caller record 44, coincidence detector 42 and gate 46 of Figure 1, plus the associated software in Figure 2. The defendants contend that the software must be configured to implement a contest that provides questions to callers, receives answers entered by the callers on the keypad of their telephones, and determines winners of the contest.

The structures identified by the defendants are discussed in Column 8, line 65 through Column 9, line 57 and Column 4, line 57 through Column 5 line 18 as part of the illustrative embodiment of a game format. ***640** In Column 6, lines 63 through 66, the specification provides that "the interface processor 26 receives the calling number and processes the contest format as described in detail below." Thus, the Court concludes that the structure that performs the function of processing calls in an interface format is the interface processor 26 of Figure 1. The Court concludes that the structures that are discussed in the

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works

context of the game format are not necessarily required to perform the function of processing calls in an interface format, because the game format is only an example of one type of interface format.

2. Claim 15

a. "Memory Means for Storing Caller Cues and Use Indications"

[59] The plaintiffs agree that all of the limitations of Claim 15 are subject to means-plus-function analysis except for the limitation that reads "memory means for storing caller cues and use indications for said caller cues in relation to said callers as identified by said identification signals." Consistent with the Court's conclusion above in footnote 14, the Court concludes that "memory means" would have connoted sufficient structure to one of ordinary skill in the art at the time of the Katz patents such that it is not subject to analysis under § 112, ¶ 6. The Court defines "memory means" as computer hardware that stores information, such as disks, RAM, or tapes.

The defendants also contend that the "caller cues" recited in this limitation must be quiz or lottery questions, as disclosed in the specification. Similar to the defendants' argument that the term "format" should be restricted to the seven disclosed formats, the Court concludes that there is no support in the claim language or specification for limiting the ordinary and common meaning of "cues" to only questions posed in a quiz or lottery. Thus, the Court construes the term "caller cues" to mean: questions or prompts which are given to a caller.

b. "Means for Selecting a Current Caller Cue"

[60] The last limitation in Claim 15 of the '984 patent reads "means for selecting a current caller cue from said memory means for one of said currently active callers for application to said cue means under control of said identification signals for said one of said currently active callers and said use indications in said memory means for said one of said currently active callers."

There is no dispute that the term "means for selecting a current caller cue" is subject to means-plus-function analysis. The function performed by the means is "selecting a current caller cue from said memory means for one of said currently active callers. under control of said identification signals ... and said use indications." The parties' dispute centers on whether the random number generator is one of the structures that correspond to the means. The defendants contend that in addition to the gate 46, the interface processor 26, the coincidence detector 42, and the associated software, the random number generator 38 is essential to perform the function called out in the claim because the specification does not provide for a way to choose questions other than randomly. The plaintiffs contend that the specification shows that the coincidence detector 42 is the structure which decides whether a question is posed to a caller based on use indications associated with that caller.

The specification describes the process of selecting a caller cue in Column 4, lines 59 through Column 5, line 1, which provides that "[g]enerally, the interface processor 26 poses questions to calling contestants.... Questions given to contestants are selected from a memory 38 by a random number generator 40. Essentially, the memory 38 contains an inventory of questions addressable by number provided by the random number generator 40. The ***641** address numbers for the generator 40 are also supplied to a coincidence detector 42 that also receives the address numerals of questions previously presented to a specific caller from a record 44." *See also* Column 8, line 65 through Column 9, line 28.

Thus, based on these passages of the specification, the Court concludes that the "means" in "means for selecting a current caller cue" corresponds to the interface processor 26, the coincidence detector 42, the random number generator 38, and the associated software to perform the function of selecting a current caller cue from memory under control of identification signals and use indications.

III. CONCLUSION

The foregoing constitutes the Court's construction of the terms presented by the parties from the twenty claims designated for the *Markman* hearing.

An appropriate Order follows.

ORDER

AND NOW, this 26th day of August, 1999, upon consideration of the briefs, expert testimony, and oral argument presented by the parties in connection with the *Markman* hearing held from May 24, 1999 through June 4, 1999, in which counsel for all parties participated, and upon consideration of the intrinsic and extrinsic records of the patents-at-issue as indicated in the foregoing Memorandum, it is hereby **ORDERED** that the meaning and scope of the patent claims asserted to be infringed and presented by the

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works

parties for construction are hereby determined as set forth in the foregoing Memorandum.

APPENDIX
ANALYSIS CONTROL SYSTEM CLAIMS
'309 Patent, Claim 51

46. A control system for use with a communication facility including remote terminals for individual callers, wherein each of said remote terminals may comprise a conventional telephone instrument including voice communication means, and digital input means in the form of an array of alphabetic numeric buttons for providing data, said control system comprising:

an interface structure coupled to said communication facility to interface said remote terminals for voice and digital communication, and including means to provide caller data signals representative of data relating to said individual callers developed by said remote terminals;

voice generator structure coupled through said interface structure for actuating said remote terminals as to provide vocal operating instructions to said individual callers;

record structure, including memory and control means, connected to receive said caller data signals from said interface structure for updating a file and storing digital caller data relating to said individual callers provided from said digital input means through said interface structure; and

qualification structure controlled by said record structure for testing caller data signals provided by a respective one of said individual callers to specify a consumable participation key for restricting the extent of access to said system to limit data stored from said respective one of said individual callers on the basis of entitlement.

51. A system according to claim 46 wherein said qualification structure restricts the extent of access by said respective one of said individual callers to a single use entitlement.

'707 Patent, Claim 33

26. An analysis control system for sue with a communication facility including remote terminals for individual callers, wherein each of said remote terminals may comprise a conventional telephone instrument including voice communication means and digital input means in the form of an array of alphabetic numeric buttons for ***642** providing data and wherein said communication facility has a capability to automatically provide calling number identification data for at least certain of said individual callers, said analysis control system comprising:

an interface structure coupled to said communication facility to interface said remote terminals for voice and digital communication;

voice generator structure coupled through said interface structure for actuating said remote terminals as to provide vocal operating instructions to said individual callers;

record structure, including memory and control means, connected to receive said calling number identification data provided automatically by said communication facility for at least certain of said individual callers, for accessing a file, and storing additional digital data provided by said callers; and

qualification structure controlled by said record structure for testing said calling number identification data to specify a basis for entitlement defining a limit on use, for restricting the extent of access to said system for a respective one of said certain of said individual callers.

33. An analysis control system according to claim 26, wherein said limit on use relates to a dollar amount.

'707 Patent, Claim 104

96. An analysis control system for use with a communication facility including remote terminals for individual callers, wherein each of said remote terminals may comprise a conventional telephone instrument including voice communication means and digital input means in the form of an array of alphabetic numeric buttons for providing data wherein said communication facility has a capability to provide call data signals indicative of calling number identification data for at least certain of said individual callers, said analysis control system comprising:

interface structure coupled to said communication facility to interface each of said remote terminals for voice and digital communication, and including means to provide signals representative of data developed by said remote terminals and for receiving said calling number identification data;

voice generator structure coupled through said interface structure for actuating said remote terminals as to provide vocal operating instructions to said individual callers;

record structure, including memory and control means, connected to said interface structure for accessing a file and storing data relating to certain select ones of said individual callers in accordance with said calling number identification data;

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works

qualification structure controlled by said record structure for controlling access to said system by said individual callers; and
means for processing at least certain of said data developed by said terminals and said calling number identification data relating to certain select ones of said individual callers.

103. A system according to claim 96 for use with a communication facility having a capability (DNIS) to provide called number identification data to identify a called number form a plurality of different numbers for calling, and further including means for selecting a specific one of a plurality of formats of said interface structure.

104. A system according to claim 103, wherein said called number identifies a specific one of a plurality of operating formats for interface.

'707 Patent, Claim 117

96. An analysis control system for use with a communication facility including remote terminals for individual callers, wherein each of said remote terminals may ***643** comprise a conventional telephone instrument including voice communication means and digital input means in the form of an array of alphabetic numeric buttons for providing data wherein said communication facility has a capability to provide call data signals indicative of calling number identification data for at least certain of said individual callers, said analysis control system comprising:
interface structure coupled to said communication facility to interface each of said remote terminals for voice and digital communication, and including means to provide signals representative of data developed by said remote terminals and for receiving said calling number identification data;
voice generator structure coupled through said interface structure for actuating said remote terminals as to provide vocal operating instructions to said individual callers;
record structure, including memory and control means, connected to said interface structure for accessing a file and storing data relating to certain select ones of said individual callers in accordance with said calling number identification data;
qualification structure controlled by said record structure for controlling access to said system by said individual callers; and
means for processing at least certain of said data developed by said terminals and said calling number identification data relating to certain select ones of said individual callers.

115. A system according to claim 96, wherein said individual callers provide other data.

116. A system according to claim 115, wherein said individual callers provide caller credit card number data as said other data.

117. A system according to claim 116, wherein said individual callers provide expiration data for caller credit card number data.

'707 Patent, Claim 192

183. An analysis control system for use with a communication facility including remote terminals for individual callers, wherein each of said remote terminals may comprise a conventional telephone instrument including voice communication means and digital input means in the form of an array of alphabetic numeric buttons for providing data and wherein said communication facility has a capability to provide calling number identification data, said analysis control system comprising:
interface structure coupled to said communication facility to interface said remote terminals for voice and digital communication and including means to receive caller data signals representative of data relating to said individual callers, including caller personal identification data and said calling number identification data provided automatically from said communication facility;
voice generator structure coupled through said interface structure for actuating said remote terminals as to provide vocal operating instructions to said individual callers and to prompt said individual callers to enter data;
record testing structure connected to receive and test said caller data signals including said calling number identification data and said caller personal identification data against previously stored calling number identification and caller personal identification data; and
analysis structure for receiving and processing said caller data signals under control of said record testing structure.

191. An analysis control system according to claim 183, wherein said communication facility automatically provides called number identification data (DNIS) to identify a select called number from a plurality of called numbers.

***644** 192. An analysis control system according to claim 191, wherein said select called number (DNIS) identifies a select format from a plurality of distinct

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works

operating formats.

'863 Patent, Claim 49

27. An analysis control system for use with a communication facility including remote terminals for individual callers, wherein said remote terminals may comprise a conventional telephone instrument including voice communication means, and digital input means in the form of an array of alphabetic numeric buttons for providing data, said analysis control system comprising:

interface structure coupled to said communication facility to interface said remote terminals for voice and digital communication, and including means to provide caller data signals representative of data relating to said individuals callers developed by said remote terminals and including means to receive called number identification signals (DNIS) automatically provided by said communication facility to identify a select one of a plurality of different called numbers associated with a select format of a plurality of different formats;

record structure, including memory and control means, said record structure connected to receive said caller data signals from said interface structure for accessing a file and storing certain of said data developed by said remote terminals relating to certain select ones of said individual callers;

qualification structure coupled to said record structure for qualifying access by said individual callers to said select format based on at least two forms of distinct identification including callers customer number data and at least one other distinct identification data element consisting of personal identification data provided by a respective one of said individual callers; and

switching structure coupled to said interface structure for switching certain select ones of said individual callers at said remote terminals to any one of a plurality of live operators wherein said live operators can enter at least a portion of said caller data relating to said select ones of said individual callers through interface terminals, which is stored in said record structure.

49. An analysis control system according to claim 27, wherein an additional form of distinct identification is provided by said individuals callers on-line and is stored for subsequent use.

'863 Patent, Claim 50

50. A system according to claim 27, wherein said qualification structure further executes a test for unacceptable customer numbers based upon data developed by said remote terminals indicative of said caller customer numbers.

27. (See above).

'863 Patent, Claim 65

65. An analysis control system for use with a communication facility including remote terminals for individual callers, wherein each of said remote terminals may comprise a conventional telephone instrument including voice communication means, and digital input means in the form of an array of alphabetic numeric buttons for providing data, said analysis control system comprising:

an interface structure coupled to said communication facility to interface said remote terminals for voice and digital communication, and including means to provide caller data signals representative of data relating to said individual callers developed by said remote terminals and including means to automatically receive called number identification signals (DNIS) to identify a select format from a plurality of formats;

voice generator structure coupled through said interface structure for actuating said remote terminals as to ***645** provide voice operating instructions to said individual callers;

record structure, including memory and control means, said record structure connected to receive said caller data signals from said interface structure for accessing a file and storing digital caller data relating to said individual callers provided from said digital input means through said interface structure; and

qualification structure for testing caller data signals provided by at least one of said individual callers to specify a consumable participation key, said consumable participation key for use during a single predetermined period of time for restricting the extent of access to at least a portion of said system by said one of said individual callers on the basis of entitlement.

'863 Patent, Claim 171

93. An analysis control system for use with a communication facility including remote terminals for individual callers, wherein each of said remote terminals may comprise a conventional telephone instrument including voice communication means and digital input means in the form of an array of alphabetic numeric buttons for providing data and wherein said communication facility has a capability to provide call data signals indicative of calling number identification data and called number

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works

identification data for at least certain of said individual callers, said analysis control system comprising:

interface structure coupled to said communication facility to interface each of said remote terminals for voice and digital communication, and including means to provide signals representative of data developed by said remote terminals and for receiving said calling number identification data and said called number identification data (DNIS) to identify one from a plurality of called numbers;

voice generator structure coupled though said interface structure for actuating said remote terminals as to provide vocal operating instructions to said individual callers;

record structure, including memory and control means, said record structure connected to said interface structure for accessing a file and storing data relating to certain select ones of said individual callers in accordance with said calling number identification data;

qualification structure controlled by said record structure for controlling access to said system by said individual callers; and

means for processing at least certain of said data developed by said remote terminals relating to certain select ones of said individual callers.

169. An analysis control system according to claim 93, wherein said data relating to certain select ones of said individual callers includes credit card number data.

171. An analysis control system according to claim 169, wherein said credit card number data is tested against unacceptable credit card numbers.

CLAIMS INVOLVING PRODUCTS CARRYING PARTICIPATION NUMBERS

'707 Patent, Claim 44

37. A process for controlling operations of an interface with a telephonic communication system including remote terminals for individual callers, wherein each of said remote terminals may comprise a conventional telephone instrument including voice communication means and digital input means in the form of an array of alphabetic numeric buttons for providing data and wherein said telephonic communication system has a central capability to automatically provide call data signals, indicative of calling number identification data (DNIS) or both, said process including the steps of:

***646** providing products carrying participation numbers specifying limits on use to entitle individual callers to access said operations of the interface with said telephonic communication system;

receiving said call data signals indicative of called number identification data including a called number (DNIS) dialed by a respective one of said individual callers to select a specific operating format from a plurality of operating formats of said operations of the interface;

coupling said remote terminals to said interface for providing voice signals to said individual callers and generating said voice signals for actuating said remote terminals as to provide vocal operating instructions to specific ones of said individual callers;

receiving digital identification data from said individual callers responsive to said voice signals including said participation numbers for said individuals callers and answer data developed by said remote terminals under control of said individuals callers;

qualifying said individual callers by testing to determine if said individual callers are entitled to access said operations of the interface based on said limits on use specified by said participation numbers for said individual callers and accordingly providing approval signals for qualified individual callers;

conditionally accessing a memory with said participation numbers and storing data relating to calls from said individual callers;

processing at least certain of said answer data responsive to said approval signals; and

providing on-going accounting data to said individual callers at intervals during calls from said individual callers.

44. A process for controlling operations of an interface with a telephonic communication system according to claim 37, further comprising the step of:

invalidating on-line said participation numbers after said limits on use specified by said participation numbers are reached.

'707 Patent, Claim 93

69. A process for controlling operations of an interface with a telephone communication system, said process including steps of:

providing products carrying participation numbers specifying limits on use to entitle individual callers to access said operations of the interface with said telephone communication system;

coupling remote terminals to said interface for providing voice signals to said individual callers and generating said voice signals for actuating said remote terminals as to provide vocal operating

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works

instructions to specific ones of said individual callers;
receiving digital identification data from said individual callers responsive to said voice signals including said participation numbers for said individual callers and answer data provided from said remote terminals under control of said individual callers;
qualifying said individual callers by testing to determine if said individual callers are entitled to access said operations of the interface based on said limits on use specified by said participation numbers for said individual callers and accordingly providing approval signals for qualified individual callers;
accessing a memory with said participation numbers for said individual callers and storing data relating to calls from said individual callers;
***647** processing at least certain of said answer data responsive to said approval signals.

93. A process for controlling operations of an interface with a telephone communication system according to claim 69, wherein said participation numbers are numbers coded for verification.

'863 Patent, Claim 79

79. A process for controlling operations of an interface with a telephonic communication system including remote terminals for individual callers, wherein each of said remote terminals may comprise a conventional telephone instrument including voice communication means and digital input means in the form of an array of alphabetic numeric buttons for providing data and wherein said telephonic communications system has a capability to automatically provide call data signals indicative of calling number identification data or called number identification data (DNIS) or both, said process including the steps of:
providing products carrying concealed participation numbers specifying limits on use to entitle said individual callers to access said operations of the interface with said telephonic communications system;
receiving said call data signals indicative of called number identification data including a called number (DNIS) dialed by individual callers to select a specific operating format from a plurality of operating formats of said operations of the interface;
coupling remote terminals to said interface for providing voice signals to said individual callers and generating said voice signals for actuating said remote terminals as to provide vocal operating instructions to specific ones of said individual callers;
receiving digital identification data from said individual callers responsive to said voice signals including said participation numbers and answer data provided from said remote terminals under control of said individual callers;
qualifying said individual callers by testing to determine if said individual callers are entitled to access said operations of the interface based on said limits on use specified by said participation numbers and accordingly approving qualified individual callers;
conditionally aborting interaction during said operations of the interface with an individual caller at an [sic] remote terminal and coupling said remote terminal to an interface terminal under predetermined conditions for direct personal communication;
accessing a memory with said participation numbers and storing data relating to calls from said individual callers; and
processing at least certain of said answer data responsive to approving said qualified individual callers.

'863 Patent, Claim 190

188. A process for controlling operations of an interface with a telephone communications system, said process including the steps of:
providing products carrying key numbers for participation specifying limits on use to entitle individual callers to access said operations of the interface with said telephone communications system;
coupling remote terminals to said interface for providing voice signals to said individual callers and generating said voice signals for actuating said remote terminals as to provide voice operating instructions to specific ones of said individual callers;
receiving digital identification data from said individual callers responsive to said voice signals including said key numbers for said individual callers and answer data provided from said ***648** remote terminals under control of said individual callers;
qualifying said individual callers by testing to determine if said individual callers are entitled to access said operations of the interface based on said limits on use specified by said key numbers for said individual callers and accordingly providing approval signals for qualified callers;
accessing a memory with said key numbers for said individual callers and storing data relating to calls

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works

from said individual callers; and
providing certain of said voice signals to said individual callers to indicate computer generated number data formed during operations of the interface.

189. A process according to claim 188, wherein said computer generated number data is stored in said memory.

190. A process according to claim 189 wherein said computer generated number data is stored in association with said digital identification data.

CONDITIONAL FORMAT CLAIMS

'150 Patent, Claim 15

10. A process for interfacing a telephonic communication system including remote terminals with a multiple port, multiple format data processing system, said multiple port, multiple format data processing system for concurrently processing data from said remote terminals according to a plurality of formats, at least one of said formats having at least one condition for a calling terminal, and wherein said telephonic communication system provides call data signals, as to indicate called and calling numbers, said process including the steps of:
receiving said call data signals from said telephonic communication system for a calling remote terminal;
selecting a processing format of said multiple port, multiple format processing system for the calling remote terminal under control of said data signals as the selected format;
testing the selected format in relation to said call data signals; and
conditionally interfacing said selected format to a calling terminal under control of said testing of call data signals.

11. A process according to claim 10 further including the step of fetching control data addressable with said call data for use in the step of testing.

15. A process according to claim 11 wherein said step of fetching control data includes fetching data to specify demographic conditions.

'285 Patent, Claim 17

17. A process for interfacing (1) a telephonic communication system including remote terminals either with (2) a multiple port, multiple format data processing system, said multiple port, multiple format data processing system for concurrently processing data from said remote terminals according to a plurality of formats at least one of said formats at lease one condition for a calling terminal, or (3) one of a plurality of operator stations with prompting capability for a plurality of formats, and wherein said telephonic communications system provides call data signals, as to indicate called and calling numbers, said process including the steps of:
receiving said call data signals from said telephonic communications system for a calling remote terminal indicative of DNIS and ANI automatically provided by said telephonic communications system;
selecting a processing format either for said multiple port, multiple format processing system or one of said plurality of operator stations for the calling remote terminal under control of said data signals as the selected format;
testing the selected format in relation to said call data signals; and
***649** conditionally interfacing said calling terminal to said multiple port, multiple format data processing system for execution of said selected format or to one of said plurality of operator stations under control of said testing of call data signals.

'285 Patent, Claim 20

20. A method for interfacing (1) a telephonic communications system including individual remote calling terminals for individual callers with (2) a multiple port, multiple format data processing system, said multiple port, multiple format data processing system for concurrently processing data from said remote terminals according to a plurality of formats, at least of one said formats having at least one specified condition for said remote terminals calling to interface said data processing system, and (3) a plurality of live operator attended terminals and wherein said telephonic communication system includes the capability of providing call data signals, said method comprising the steps of:
receiving said call data signals from said telephonic communications system for said remote terminals calling to interface said data processing system including DNIS automatically provided by said telephonic communication system;
selecting for said remote terminals a select processing format from said plurality of formats of said multiple port, multiple format data processing system under control of said call data signals including DNIS provided by said telephonic communications system;
testing said select processing format in relation to

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works

said call data signals;
conditionally interfacing said selected processing format to said remote terminals selectively terminating certain select calls from said remote terminals in favor of said operator attended terminals; and
transferring substantially all of said certain select calls from said operator attended terminals back to said multiple port, multiple format data processing system.

'285 Patent, Claim 24

19. A method for interfacing (1) a telephonic communications system including individual remote calling terminals for individual callers with (2) a multiple port, multiple format data processing system, said multiple port, multiple format data processing system for concurrently processing data from said remote terminals according to a plurality of formats, at least of one said formats having at least one imposed condition for said remote terminals calling to interface said data processing system and (3) a plurality of live operator attended terminals and wherein said telephonic communication system includes the capability of providing call data signals, said method comprising the steps of:
receiving said call data signals from said telephonic communications system for said remote terminals calling to interface said data processing system including DNIS automatically provided by said telephonic communication system;
selecting for said remote terminals a select processing format from said plurality of formats of said multiple port, multiple format data processing system under control of said call data signals including DNIS provided by said telephonic communications system;
testing said select processing format in relation to said call data signals;
conditionally interfacing said select processing format to said remote terminals under control of said testing in relation to said call data signals; and
selectively terminating certain select calls from said remote terminals in favor of said operator attended terminals.

*650 22. A method for interfacing a telephonic communications system according to claim 19, further comprising the step of:
providing signal-represented call data from said remote terminals including calling numbers as additional call data signals.

24. a method for interfacing a telephonic communications system according to claim 22, further comprising the steps of:
storing a record of negative file data, said select processing format using said additional call data signals to access said record and obtain data to specify and test for negative file conditions; and
terminating calls from said remote terminals if said calling number matches said data obtained from said negative file data.

'285 Patent, Claim 77

65. An interface control system for use with, (1) a communication facility including remote terminals for individual callers to make calls, wherein said remote terminals may comprise a conventional telephone instrument including voice communication means and some of said remote terminals may further comprise digital input means for providing data, and (2) a multiple port, multiple format processor for concurrently processing data from a substantial number of callers in any of a plurality of formats, said communication facility automatically provides call data signals, as to indicate called data (DNIS), to select a particular format from said plurality of formats, and (3) a plurality of live operator attended terminals with prompting capability, for a plurality of formats, said interface control system comprising:
interface means for providing automated voice messages relating to a specific format to certain of said individual callers, wherein said certain of said individual callers digitally enter data through said digital input means;
means for directly forwarding a call coupled to said interface means for forwarding a call from any one of said remote terminals to one of said plurality of live operator attended terminals under control of said call data signals when said remote terminals do not have the capability to digitally provide data;
means for processing coupled to said live operator attended terminals for processing caller information data entered by an operator at said live operator attended terminal; and
means for storing coupled to said interface means and said processing means for storing certain select data from said caller information data entered by said operator and data entered digitally by said individual callers.

77. An interface control system according to claim 65, wherein at least one of said plurality of formats has at least one imposed condition for said remote terminals calling to interface said interface control system.

'984 PATENT CLAIMS

'984 Patent, Claim 4

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works

1. A telephone call processing system for receiving calls from a multitude of terminals in different call modes including an "800" call mode and a "900" call mode for processing to an interface format and involving digital signals associated with said terminals as for identification or data, said system comprising:

first response unit means for receiving calls in said "800" call mode;

qualification means for qualifying said calls in said "800" call mode received by said first response unit to provide qualified calls;

second response unit means for receiving calls in a second call mode;

means for processing calls in an interface format; and

***651** means for coupling said qualified calls and said calls in a second mode to said means for processing.

4. A system according to claim 1 wherein said qualification means comprises means for testing said digital signals associated with said terminals originating said calls.

'984 Patent, Claim 15

15. A telephone interface system for individually interfacing callers at a multitude o[f] remote terminals for voice-digital communication through a telephone communication facility, said system comprising:

communication means for establishing telephone communication with currently active callers at certain of said terminals through said telephone communication facility;

means for providing identification signals to said communication means indicative of said currently active callers, said means for providing identification signals comprising means for providing at least a portion of the digits associated with a remote terminal for identification;

memory means for storing caller cues and use indications for said caller cues in relation to said callers as identified by said identification signals;

cue means for receiving said caller cues to provide voice signals through said communications means to prompt responses from said currently active of said callers in the form of digital data signals; and

means for selecting a current caller cue from said memory means for one of said currently active callers for application to said cue means under control of said identification signals for said one of said currently active callers and said use indications in said memory means for said one of said currently active callers.

63 F.Supp.2d 583

END OF DOCUMENT

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works

6651ED" 7h2022b0

Only the Westlaw citation is currently available.

This case was not selected for publication in the Federal Reporter.

NOTE: Pursuant to Fed.Cir.R. 47.6, this order is not citable as precedent. It is public record.

Please use FIND to look at the applicable circuit court rule before citing this opinion. Federal Circuit Rule 47.6. (FIND CTAF Rule 47.6.)

United States Court of Appeals, Federal Circuit.

MARLOW INDUSTRIES, INC., Plaintiff-Appellant,
v.
IGLOO PRODUCTS CORP., Defendant-Appellee.

No. 02-1386.

May 23, 2003.

Before LOURIE, LINN, and PROST, Circuit Judges.

PROST, Circuit Judge.

*1 Marlow Industries, Inc. ("Marlow") appeals from the decision of the United States District Court for the Northern District of Texas granting summary judgment to Igloo Products Corp. and holding Marlow's United States Patent No. 4,726,193 ("the '193 patent"), as amended by Reexamination Certificate B1 4,726,193 ("the first reexamination") and Reexamination Certificate U.S. 4,726,193 C2 ("the final reexamination") unenforceable due to Marlow's inequitable conduct before the United States Patent and Trademark Office ("PTO"). *Marlow Indus., Inc. v. Igloo Prods Corp.*, No. 396-CV-2688-P, 2002 WL 485698 (N.D.Tex. Mar. 28, 2002). Because the district court did not commit error in granting Igloo's motion for summary judgment, we *affirm* the judgment.

I

The '193 patent covers picnic boxes. Independent claim 1 reads in pertinent part "[a] refrigerator/food warmer picnic box apparatus or the like comprising ... means ... for *selectively heating and cooling* and circulating the air in the food compartment picnic box ...." (emphasis added). Marlow filed an infringement action against Igloo in September 1996 and cross-moved for partial summary judgment on September 29, 1997, claiming that, as a matter of law, several of the contested picnic boxes infringed the patent.

In an opinion dated April 3, 1998, the district court concluded, "it is obvious that the plain meaning of Claim 1 requires that the picnic box be capable of both 'heating and cooling." ' Both parties moved the court to reconsider its April 3 order. On September 1, 1998, the district court entered an order denying Marlow's motion for reconsideration, but granting Igloo's motion in part by vacating its prior ruling that some of the accused picnic boxes literally infringed the '193 patent, concluding rather that none of the accused products literally infringed the patent. The court left open several issues regarding infringement under the doctrine of equivalents.

In June 1998, Igloo requested the PTO to reexamine the '193 patent to consider prior art that was not previously considered. Marlow subsequently moved to stay further action in the district court until completion of the reexamination proceedings. Igloo's request for the final reexamination brought to the examiner's attention the pending infringement litigation in the district court between Marlow and Igloo, and included a copy of Marlow's brief in support of its September 29, 1997, motion for partial summary judgment. During the reexamination, Marlow attempted to amend the patent by adding claims 4 and 5. These claims included language that covers a picnic box, which "cools or heats" (independent claim 4) and which "only cools" (claim 5, depending from claim 4). The examiner rejected these claims pursuant to 35 U.S.C § 305, which prohibits expanding the scope of the claimed invention during a reexamination.

Marlow then attempted for a second time to amend the patent by adding claims 6 and 7. These claims, both depending from claim 1, included language covering a picnic box, which "heats and circulates only warm air" (claim 6) and which "cools and only circulates cooled air" (claim 7). The examiner again rejected these claims as an attempt to impermissibly broaden the scope of the original patent. Marlow appealed the examiner's rejection of its claims, including the rejection of its four proposed amendments, to the Board of Patent Appeals and Interferences ("Board"). The Board affirmed the examiner's rejection of proposed claims 5-7. However, the Board reversed the examiner's rejection

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works

of claim 4 on the basis that it, like preexisting claim 1, includes the "selectively heating and cooling" language and, thus, cannot be construed as enlarging the scope of the claimed invention.

***2** In August 2001, Igloo moved for summary judgment in the district court, in which the infringement action was pending, alleging that Marlow had committed inequitable conduct by failing to disclose to the examiner during the final reexamination of the '193 patent the court's prior claim construction of that patent. The district court determined that Marlow had failed during the reexamination to provide the examiner with the court's April 3 and September 1, 1998 orders, that these orders were material to the reexamination proceeding, and that Marlow knew or should have known that a patent examiner would have found such information material. The district court also found that Marlow failed to submit to the examiner its motion for reconsideration of the court's April 3 order, but the court did not analyze Marlow's inequitable conduct with regard to its failure to submit this document. Based upon these findings, the court concluded that Marlow engaged in inequitable conduct before the PTO. The district court therefore granted Igloo's motion for summary judgment and declared all claims of the '193 patent unenforceable.

Marlow filed a timely appeal and we have jurisdiction pursuant to 28 U.S.C. § 1295(a)(1).

II

We review the district court's grant of summary judgment *de novo*, with all justifiable factual inferences being drawn in favor of the party opposing the motion. *See Anderson v. Liberty Lobby, Inc.*, 477 U.S. 242, 255 (1986). Summary judgment is appropriate where there is no genuine issue of material fact and the moving party is entitled to judgment as a matter of law. *See* Fed.R.Civ.P. 56(c). Under *Anderson*, whether a given factual dispute requires submission to a jury must be guided by the substantive evidentiary standards that apply to the case. 477 U.S. at 255. It is the substantive law's identification of which facts are critical and which facts are irrelevant that governs whether a genuine issue of material fact exists. *Id.* at 247-48.

It is well settled that patent applicants are required to prosecute patent applications "with candor, good faith, and honesty." *Molins PLC v. Textron, Inc.*, 48 F.3d 1172, 1178, 33 USPQ2d 1823, 1826 (Fed.Cir.1995). This duty likewise applies to reexamination proceedings. 37 C.F.R. § 1.555 (2002). A breach of this duty can take several forms, including the failure to disclose material information. *Molins*, 48 F.3d at 1178, 33 USPQ2d at 1826. Further, a breach of this duty, when coupled with an intent to deceive or mislead the PTO, constitutes inequitable conduct, which, when proven, renders the patent unenforceable. *Id.* at 1178, 33 USPQ2d at 1827.

To establish Marlow's inequitable conduct, Igloo must show by "clear and convincing evidence" that Marlow failed to disclose material information with intent to deceive the PTO. *Kingsdown Med. Consultants, Ltd. v. Hollister, Inc.*, 863 F.2d 867, 872, 9 USPQ2d 1384, 1389 (Fed.Cir.1988); *FMC Corp. v. Manitowoc Co.*, 835 F.2d 1411, 1415, 5 USPQ2d 1112, 1115 (Fed.Cir.1987). Once the materiality of the information and Marlow's intent to mislead have been established, the district court must "weigh them to determine whether the equities warrant a conclusion that inequitable conduct occurred." *Molins*, 48 F.3d at 1178, 33 USPQ2d at 1827. Moreover, when balanced against high materiality, the showing of intent can be proportionally less. *Brasseler, U.S.A. I, L.P. v. Stryker Sales Corp.*, 267 F.3d 1370, 1381, 60 USPQ2d 1482, 1488 (Fed.Cir.2001).

***3** On appeal, Marlow maintains that the district court erred in granting summary judgment to Igloo because it raised genuine issues of material fact. According to Marlow, the district court impermissibly weighed the evidence regarding its failure to disclose information to the PTO, the materiality of the allegedly withheld information, and Marlow's intent to deceive the PTO. Igloo counters that Marlow has no additional evidence to offer that would warrant changing the district court's determination or that would otherwise merit further proceedings. After drawing all justifiable inferences in favor of Marlow, we conclude that there are no genuine issues of material fact with regard to Marlow's inequitable conduct and Igloo is entitled to judgment as a matter of law.

A

Marlow first argues that a genuine issue of material fact exists with regard to whether it withheld any information relating to the district court action from the PTO during the final reexamination. In this regard, Marlow notes that it advised the examiner that the '193 patent was the subject of an infringement action pending before the district court, the examiner was provided with copies of the particular documents relating to those proceedings

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works

which Igloo believed relevant to the final reexamination, and the entire record was made available to the examiner by Marlow's and Igloo's disclosures.

Igloo maintains that Marlow never once apprised the examiner of the substance of the district court's claim construction of the '193 patent or even of the fact that the court had construed the patent. Igloo specifically contends that the district court correctly found that Marlow failed to submit the three disputed documents to the examiner.

The district court did not err in concluding that there was no genuine issue of material fact with respect to Marlow's failure to submit copies of the disputed documents to the examiner during the final reexamination. In its responses to Igloo's Requests for Admission Nos. 92-94, Marlow admitted that at the time of the issuance of the final reexamination, the file wrapper did not include copies of these documents. We reject Marlow's argument that a genuine issue of material fact exists as to whether it withheld any information relating to the infringement action from the PTO. Informing the examiner of the pending infringement action is not commensurate with bringing to the examiner's attention the district court's prior claim construction of the patent or disclosing the court orders embodying this construction. *See* Rohm & Haas Co. v. Crystal Chem. Co., 722 F.2d 1556, 1572-73, 220 USPQ 289, 302 (Fed.Cir.1983) (concluding that a presumption that an examiner was able to find, with his expertise and adequate time, the critical data when he was presented with a "mountain of largely irrelevant data" ignores the real world conditions under which examiners work). Moreover, the only document from the infringement litigation submitted to the examiner was Marlow's motion for partial summary judgment filed on September 25, 1997, which was included as an exhibit to Igloo's request for reexamination. This document, however, was filed in the district court more than six months prior to the court's initial construction of the '193 patent and, thus, had no bearing on the scope of the claims at issue during the reexamination proceedings.

B

*4 Marlow next argues that a genuine issue of material fact exists with regard to the materiality of the district court's claim construction orders. "Materiality is not limited to prior art but embraces *any* information that a reasonable examiner would be substantially likely to consider important in deciding whether to allow an application to issue as a patent." *GFI, Inc. v. Franklin Corp.*, 265 F.3d 1268, 1273, 60 USPQ2d 1141, 1143 (Fed.Cir.2001) (emphasis in original); 37 C.F.R. § 1.56(b) (2002).

Marlow contends that in reaching its finding that its previous orders were material to the examiner's final reexamination of the '193 patent, the district court erroneously assumed that: (1) the construction of claim 1, and thus claim 4, applied by the Board was in conflict with the district court's construction of claim 1; and (2) Marlow was attempting during the reexamination to avoid the district court's requirement that to infringe the '193 patent an accused device had to be capable of both heating and cooling. According to Marlow, it argued to the examiner that claim 1 could not require both "simultaneous" heating and cooling because that would be physically impossible, which is not inconsistent with the district court's interpretation of the claim.

Igloo responds that the district court correctly concluded that the disputed documents were material to the final reexamination because: (1) they bore directly on the scope of the claims that Marlow attempted to amend; and (2) Marlow's interpretation of the patent asserted before the examiner was inconsistent with the district court's construction of the patent and Marlow's acquiescence to that construction.

The district court did not err in concluding that there was no genuine issue of material fact with respect to the materiality of the April 3 and September 1, 1998, orders to the final reexamination from the standpoint of a reasonable examiner reviewing Marlow's proposed amendments. Faced with Marlow's attempts to amend claim language in the '193 patent, the examiner had to first construe the scope of the claims, including the specific language covering picnic boxes that are capable of both "heating and cooling," to determine whether the proposed "cools or heats" language would impermissibly enlarge the scope of the patent. *See* 35 U.S.C. § 305(a) (2002). In addition, the district court's two previous orders construing the '193 patent and concluding that picnic boxes that only cooled did not infringe the patent were binding on the examiner under the doctrine of issue preclusion. *See In re Freeman*, 30 F.3d 1459, 1466-69, 31 USPQ2d 1444, 1448-51 (Fed.Cir.1994) (concluding that the Board was bound by the district court's prior interpretation of the reissue claims under the doctrine of issue preclusion). Thus, a reasonable examiner would have been substantially likely to consider these two orders important in deciding whether to allow the amendments to issue.

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works

*5 Moreover, contrary to Marlow's assertion, whether or not the Board, applying the same construction of claim 1 as the district court, found claim 4 equivalent in scope to claim 1 is irrelevant to the materiality inquiry. This court has articulated the materiality criterion as follows:

> [T]he standard to be applied in determining whether a reference is "material" is not whether the particular examiner of the application at issue considered the reference to be important; rather, it is that of a "reasonable examiner." Nor is a reference immaterial simply because the claims are eventually deemed by an examiner to be patentable thereover.

Molins, 48 F.3d at 1179, 33 USPQ2d at 1828 (citation omitted); *Perseptive Biosystems, Inc. v. Pharmacia Biotech, Inc.*, 225 F.3d 1315, 1322, 56 USPQ2d 1001, 1006 (Fed.Cir.2000) (stating that a patent may be valid and yet be rendered unenforceable due to inequitable conduct). Thus, that the Board's interpretation of the '193 patent may have been consistent with the district court's previous construction does not eviscerate the materiality of the previous orders from the viewpoint of a reasonable examiner in the first instance. Here, a reasonable examiner reviewing Marlow's proposed amendments would have considered the district court's prior construction of that patent important.

C

Lastly, Marlow argues that a genuine issue of material fact exists with regard to Marlow's intent to deceive the PTO. Intent to mislead does not require direct evidence, and is typically inferred from the facts. *GFI*, 265 F.3d at 1274, 60 USPQ2d at 1144. Intent may be inferred when a patent applicant knew, or should have known, that withheld information could be material to the PTO's consideration of the patent application. *Critikon, Inc. v. Becton Dickinson Vascular Access, Inc.*, 120 F.3d 1253, 1256-57, 43 USPQ2d 1666, 1668-69 (Fed.Cir.1997); *Brasseler*, 267 F.3d at 1375-76, 60 USPQ2d at 1484; *Merck & Co. v. Danbury Pharmacal, Inc.*, 873 F .2d 1418, 1422, 10 USPQ2d 1682, 1686 (Fed.Cir.1989) (stating that intent is most often proven by a showing of acts the natural consequences of which are presumably intended by the actor).

Marlow argues that a factual dispute exists with regard to its alleged intent to deceive the PTO. According to Marlow, the district court found intent by incorrectly assuming that claim 4 is broader than claim 1 and by disregarding the affidavit of Marlow's attorney denying an intent to deceive.

Igloo argues that the district court correctly concluded that Marlow acted with intent to deceive the PTO. According to Igloo, Marlow knew, or should have known that the examiner would have considered the district court's claim construction of the '193 patent (specifically its holding that cool only or heat only devices cannot infringe the '193 patent) material to Marlow's attempts to add claims directed to cool only or heat only devices. Igloo further contends that the affidavit of Marlow's counsel does not create a genuine issue of fact as to Marlow's intent because it consists of mere denials of an intent to deceive.

*6 The district court did not err in concluding that there was no genuine issue of material fact with respect to Marlow's intent to deceive the PTO by failing to submit the district court's prior orders construing the claims of the '193 patent when it proposed amended language during the final reexamination. The same attorney represented Marlow before the district court in this case and before the PTO during the final reexamination proceedings. *See Critikon*, 120 F.3d at 1257, 43 USPQ2d at 1669 (noting that the patent counsel who were handling the reissue proceedings were keenly aware of the ongoing district court litigation and the issues involved prior to the resolution of the reissue proceedings). Yet, despite the district court's prior holding that a picnic box had to both heat and cool to infringe the '193 patent, Marlow proposed claims using the disjunctive language of "cools or heats." *See In re Freeman*, 30 F.3d at 1465, 31 USPQ2d at 1448 (stating that "given the interpretation of the district court during the infringement litigation, it is clear that the amendments to the independent claims during reexamination attempt[ed] an end run around the [district court's] interpretation"). Under these circumstances and in light of the binding nature of the district court's prior claim construction, Marlow's failure to submit the April 3 and September 1, 1998, orders leads to a finding that Marlow intended to deceive the PTO. As the district court recognized when considering Igloo's inequitable conduct motion, Marlow should have known that a patent examiner would have found the two prior court orders considering the construction of the '193 patent material to the reexamination. Indeed, during the pendency of the reexamination, Igloo's counsel twice reminded Marlow by letter of its duty to disclose the district court's claim construction to the examiner. The only evidence Marlow offers to negate a finding of an intent to deceive is an affidavit from its counsel denying such deceitful intent. However, a mere denial of an intent to deceive is not sufficient where a

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works

patentee faces a high level of materiality and proof that it knows or should have known of that materiality. *Critikon*, 120 F.3d at 1257, 43 USPQ2d at 1669 (citing *FMC Corp .*, 835 F.2d at 1415, 5 USPQ2d at 1116).

CONCLUSION

In sum, we conclude that viewing the evidence in the light most favorable to Marlow, there is no genuine issue of material fact as to the materiality of the district court's April 3 and September 1, 1998, orders to the final reexamination of the '193 patent and Marlow's intent to deceive the PTO. Furthermore, the district court did not abuse its discretion in holding the '193 patent unenforceable. Accordingly, we affirm the district court's order granting summary judgment of invalidity to Igloo.

2003 WL 21212626 (Fed.Cir.)

END OF DOCUMENT

Copr. © West 2003 No Claim to Orig. U.S. Govt. Works